

# Examination of Self-Efficacy and Locus of Control in Protecting Community

## Integration Following Moderate to Severe Traumatic Brain Injury

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## Abstract

### Examination of Self-Efficacy and Internal Locus of Control in Predicting Community Integration Following Moderate to Severe Traumatic Brain Injury

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A dissertation proposal submitted in partial fulfillment of the requirements of the degree of Doctor of Psychology at Marshall University

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This study examines self-efficacy and internal locus of control beliefs as predictors of community integration independent of injury severity for a group of individuals with moderate to severe traumatic brain injury participating in an intensive life skills training program, Radical Rehab Solutions (RRS). Although the long-term affects associated with TBI vary depending on the type and severity of the injury, differences in recovery are seen for persons who appear to have identical injuries (Fuller, 1998). Traditional methods of predicting outcome based on measures of injury severity appear to be the most useful during the first year post-injury. Thereafter, neurological, psychological, and environmental processes appear to interact to influence recovery outcomes. The purpose of the current study is to move beyond the narrow focus of medical restoration approaches to provide further support for a model that conceptualizes cognitive beliefs as predictors of outcome following TBI independent of injury severity.

**Background:** TBI is the leading cause of long-term disability among children and young adults (NIH, 1998). Although advances in acute medical management have enabled people to survive injuries that previously would have been fatal (Khan, Baguley, & Cameron, 2003), these innovations have presented health-care professionals with the

challenges of rehabilitating and reintegrating persons with profound, multi-system life changes (Stambrook & Moore, 1995). Preliminary research with TBI populations supports the premise that self-efficacy and locus of control beliefs play an important role in determining outcome following TBI, but has been limited methodologically. Existing studies have exclusively utilized single-measurement designs to establish relationships between cognitive variables and outcomes following TBI, limiting the extent to which researchers can determine whether cognitive variables are related to the dependent measure of outcome over time. **Method:** A pre-test post-test design was utilized to examine the impact of internal locus of control and self-efficacy beliefs on community integration over time. Participants completed the Multidimensional Health Locus of Control (Form C), the Chronic Disease Self-Efficacy Scales (CDSES), and the Community Integration Questionnaire (CIQ) at baseline and at 90-day follow-up. Data regarding injury severity, change in self-efficacy from pre-test to post-test, and change in internal locus of control from pre-test to post-test were entered into multiple regression analyses in order to determine the influence upon change in community integration from baseline to follow-up. **Participants:** A sample of 24 participants, ages 22 to 57, were recruited from a holistic, intensive life skills training program (RRS) located in southern West Virginia and eastern Kentucky. Time since injury ranged from 12 months to 444 months, and the length of time unconscious ranged from 1 hour to 195 days. **Results:** It was hypothesized that change in internal locus of control and self-efficacy beliefs would be more predictive of change in community integration from baseline to follow-up than injury severity. Injury severity was not found to be a significant predictor of change in overall community integration, change in home integration, change in social integration,

or change in productivity on the CIQ. Change in internal locus of control was a significant predictor of change in home integration, accounting for 18% of the variance. Change in vocational self-efficacy was found to be a significant predictor of change in productivity, accounting for 34% of the variance. **Conclusions:** These findings provide partial support for the hypothesis and a model that views cognitive beliefs as predictors of outcome following TBI independent of injury severity. Further research is needed examining the role of self-efficacy and locus of control beliefs in TBI recovery over time that utilizes greater follow-up intervals as well as larger and more culturally diverse samples. In addition, future studies examining neurological and psychological factors underlying control of reinforcement appraisals for individuals following TBI as well as outcome studies of interventions targeting self-efficacy and locus of control beliefs are warranted.

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## CHAPTER ONE

### Introduction

Traumatic brain injury (TBI) is the leading cause of long-term disability among children and young adults (National Institutes of Health [NIH], 1998). Although recent medical advances have allowed individuals to survive TBI that previously would have been fatal, TBI may result in lifelong impairment of an individual's physical, cognitive, and psychosocial functioning. While TBI can cause long-term physical disability, it is the complex neurobehavioral sequelae that produce the greatest disruption to quality of life. Cognitive and behavioral changes, difficulties in maintaining personal relationships, and problems coping with school or work are reported by survivors as more disabling than any residual physical deficits (Khan, Baguley, & Cameron, 2003). TBI is a disorder of major public health significance and affects an estimated 2.5 million to 6.5 million individuals (NIH, 1998).

Although the long-term effects associated with TBI vary depending on the type and severity of the injury, differences in recovery are seen in persons who appear to have identical injuries (Fuller, 1998). Traditional methods of predicting outcome based on measures of injury severity appear to be most useful during the first year post-injury. Thereafter, a combination of environmental, psycho-social, and psychological differences may account for more outcome variability (Brooks, 1990). Recovery following TBI tends to slow and appears to plateau following the first year post-injury. Perceiving that their rehabilitation efforts are of no avail, it may be that some TBI survivors become hopeless and experience a decline in motivation at this point (Radical Rehab Solutions, 2003). Therefore, it is likely that neurological and psychological processes interact as

individuals attempt to adapt and cope with their injuries (Ownsworth, McFarland, & Young, 2002).

Research with a variety of populations involved in rehabilitation of chronic health problems has established the importance of locus of control and self-efficacy beliefs on one's ability to mobilize coping resources towards attaining meaningful outcomes (Marks, 2001). Unfortunately, TBI rehabilitation has traditionally ignored the role of psychological variables, focusing instead on psychometrically guided retraining to remediate skill deficits identified through testing and physically guided efforts which focus on retraining components of complex behaviors (Stambrook & Moore, 1995). The narrow focus of medical restoration approaches is being increasingly criticized as a major limitation in TBI rehabilitation (NIH, 1998). Preliminary research examining the role of self-efficacy and locus of control beliefs with TBI populations suggests that these variables are an important component to individuals' ability to benefit from rehabilitation efforts (Dumont, Gervais, Fougereyrollas, & Bertrand, 2004; Stambrook & Moore, 1995).

Research with TBI populations suggests that beliefs may be shaped by factors independent of injury severity, but remain associated with long-term rehabilitation outcomes. It appears that TBI patients may be at risk for developing self-limiting cognitive beliefs as they attempt to account for the cognitive, behavioral, emotional, and interpersonal changes resulting from their injuries. Such belief systems limit the individual's ability to engage in effective rehabilitation and are characterized by external locus of control beliefs, a helpless and hopeless cognitive style, low levels of self-efficacy, and poor choice of coping strategies. It may be that the self-fulfilling nature of

these belief systems may in turn lead to poorer quality of life outcomes, reinforcing the belief systems, and creating a negative cycle.

Although preliminary research supports such a model, existing studies have been limited in terms of methodology, utilizing single-measurement designs which do not allow examination of the impact of locus of control and self-efficacy beliefs on outcomes following TBI over time. Furthermore, given the concrete thinking characteristic of TBI populations, and potential difficulty for these individuals to benefit from abstract, psychological interventions, researchers have suggested the need for outcome studies examining the effectiveness of ecologically-based rehabilitation efforts aimed at promoting positive belief systems.

The purpose of the current study is to test a model which conceptualizes cognitive beliefs as predictors of outcome following TBI independent of injury severity. In order to build upon the methodological weaknesses of existing studies, a pre-test post-test design was utilized to allow for examination of the impact of self-efficacy and locus of control beliefs on community integration over time. Difference scores were used to evaluate the impact of the independent variables on the dependent variables in an attempt to move a step beyond establishing purely correlational relationships. Given managed healthcare's focus on efficient services, a three-month follow-up interval was used in this study in order to evaluate short-term treatment gains.

### *Hypothesis*

The hypothesis for the present study was established based upon previous research pertaining to the role of cognitive beliefs as predictors of outcomes following TBI. The hypothesis hence served to build upon existing research in this area and

addresses the question of whether self-efficacy and locus of control beliefs are predictive of outcomes following TBI over time. The major hypothesis addressed in this study was as follows: Change in internal locus of control and self-efficacy beliefs will be more predictive of change in community integration than injury severity.

## CHAPTER TWO

### Literature Review

#### *Theoretical Underpinnings*

Lazarus and Folkman (1984) define psychological stress as “a particular relationship between the person and the environment that is appraised by the person as taxing or exceeding his or her resources and endangering his or her well-being” (p. 19). According to Lazarus’ transactional model of stress, the person-environment relationship is mediated by two processes: cognitive appraisal and coping (1984). In this framework, cognitive appraisal is an evaluative and continuous “process of categorizing an encounter and its various facets with respect to its significance for well being” that is divided into primary and secondary appraisal (p. 31). Primary appraisal concerns the process by which individuals determine the potential threat or benefit of a particular encounter with the environment as irrelevant, benign-positive, or stressful. An interaction with the environment is appraised as irrelevant when the person is not invested in the outcome and perceives no associated impact of the interaction on his or her well-being. When an environmental encounter is perceived as having a positive or constructive outcome for the individual’s well-being, and is associated with pleasurable emotions such as exhilaration or happiness, it is appraised as benign-positive. Stressful appraisals, on the other hand, are further categorized into harm/loss, threat, or challenge. Harm/loss appraisals typically occur when the individual has already sustained some damage to meaningful or important domains of their lives, as is the case with incapacitating illnesses or loss of a loved one. Threat appraisals are distinguished from harm/loss appraisals in that they involve harms or losses that have not yet taken place, but are anticipated and “permit

anticipatory coping” (p. 33). Challenge appraisals focus on the potential for personal growth outcomes as a result of a person-environment transaction. Although challenge appraisals also call for the mobilization of coping resources, they are distinguished from threat appraisals because the focus is on potential gain or growth from a given situation rather than on loss.

Whereas primary appraisals are concerned with evaluating the potential threat or benefit of an encounter with the environment, secondary appraisals are concerned with what, if anything, can be done to address or manage environmental encounters. According to Lazarus and Folkman (1984), secondary appraisal “is a complex evaluative process which takes into account which coping options are available, the likelihood that a given coping option will accomplish what it is supposed to do, and the likelihood that one can apply a particular strategy or set of strategies effectively” (p. 35). Primary and secondary appraisals interact and shape the content of individuals’ emotional reactions as well as subsequent coping activity.

Lazarus and Folkman (1984) define coping as “constantly changing cognitive and behavioral efforts to manage specific external and/or internal demands that are appraised as taxing or exceeding the resources of the person” (p. 141). Although a variety of coping functions are addressed in the literature, the transactional model distills these into problem-focused forms of coping, aimed at directly managing the problem causing the distress, and emotion-focused forms of coping, aimed at regulating the emotional response to the problem. Emotion-focused forms of coping are described as being more likely to occur when it has been appraised that nothing can be done to modify environmental variables. On the other hand, problem-focused forms of coping are

described as more likely to occur when it has been appraised that environmental variables are manageable or susceptible to change. However, Lazarus and Folkman (1984) note that coping efforts are independent of coping outcome, such that they include “anything a person does or thinks, regardless of how well or badly it works” (p. 142). In summary, the person-environment transaction is mediated by cognitive appraisal and coping efforts which effect the nature and intensity of the stress response.

Lazarus and Folkman (1984) recognized that constructs inherent in social learning theory are compatible with those central to the transactional model of stress. Congruent with secondary appraisal, which includes evaluation of whether or not an individual can utilize available coping options successfully, Bandura (1977) defined self-efficacy as the belief that one can successfully execute the behavior required to produce an outcome. He related his concept to positive appraisals of control in specific situations, subjective judgments of one’s ability to cope with prospective or hypothetical situations, and expectations of personal mastery. Just as the transactional model asserts that cognitive appraisals influence coping behaviors, Bandura (1977) argued that expectations of personal efficacy determine whether coping efforts are initiated, the degree of effort expended, and how long efforts will be sustained when obstacles and aversive experiences are encountered.

According to Bandura (1977), expectations of personal efficacy are based on four sources of information: performance accomplishments, vicarious experience, verbal persuasion, and emotional arousal. Performance accomplishments are particularly influential because they are based on personal mastery experiences, such that successes raise mastery expectations and repeated failures lower them. In other words, if an

individual's initial coping efforts are successful, the sense of self-efficacy may be enhanced. However, if initial efforts fail, self-efficacy may decrease. Vicarious experience influences self-efficacy through modeling, such that seeing others successfully complete threatening activities may generate observers' expectations that they too can engage in the activity without aversive consequences. Verbal persuasion refers to the use of suggestion to convince others that they can cope successfully with previously overwhelming stressors. Finally, emotional arousal provides cues related to personal competency by allowing individuals to judge their level of anxiety. According to Bandura (1977), "because high arousal usually debilitates performance, individuals are more likely to expect success when they are not beset by aversive arousal than if they are tense and viscerally agitated" (p. 198).

Bandura's theory focuses on expectations of personal efficacy, and he notes the distinction between efficacy expectancies and response-outcome expectancies. According to Bandura (1977), efficacy expectancy refers to the conviction that one can successfully execute the behavior required to produce an outcome, while outcome expectancy refers to a person's estimate that a given behavior will lead to certain outcomes. Bandura indicates that distinction between the two constructs is important because

. . . individuals can believe that a particular course of action will produce certain outcomes, but if they entertain serious doubts about whether they can perform the necessary activities such information does not influence their behavior (p. 193).

While Bandura stresses the importance of efficacy expectancies in determining behavior, Rotter's focus seems to be on outcome expectancies. Rotter, Chance, & Phares (1972) define expectancy as "the probability held by the individual that a particular



reinforcement will occur as a function of a specific behavior on his part in a specific situation or situations” (p. 12). Expectancies are influenced by an individual’s past history of reinforcement, the perception of a causal relationship between behavior and reinforcement, as well as the degree of generalization of expectancies from past related “behavior-reinforcement sequences” (p. 24). In novel situations, generalized expectancies will weigh more heavily in the determination of cognitive appraisal than will specific expectancies. Although Rotter’s theory encompassed both specific and general expectancies, his concept of generalized expectancies contributes to an understanding of the transactional model beyond that of situation-specific appraisal.

According to Lazarus and Folkman (1984) beliefs are “personally formed or culturally shared cognitive configurations” that serve as a perceptual lens through which individuals view reality (p. 63). Beliefs influence appraisal because they shape the individual’s perception and understanding of his or her relationship to the environment. Lazarus and Folkman (1984) indicate that beliefs regarding personal control are especially relevant to appraisal as they influence mastery and confidence. Rotter’s (1966) concept of locus of control represents general expectancies regarding personal control. According to Rotter (1966), internal locus of control refers to the belief that events are contingent upon one’s own behavior, whereas external locus of control refers to the belief that events are contingent upon luck, chance, fate, or powerful others. Lazarus and Folkman (1984) acknowledge the influence of general expectancies on specific appraisal, noting that “under conditions of ambiguity, a general expectancy would be translated into a control appraisal with respect to the specific situation” (p. 66). In other words, in a novel situation, individuals with an internal locus of control would

appraise the situation as controllable, while individuals with an external locus of control would appraise the same situation as uncontrollable.

Lazarus' transactional model, with Bandura's self-efficacy construct conceptualized as an inherent appraisal variable, and Rotter's locus of control construct conceptualized as a general belief influencing appraisal, serves as a practical framework for examining cognitive appraisal and coping for individuals engaged in TBI rehabilitation. Survivors of TBI, particularly those with severe injury, generally sustain what may be permanent changes in cognitive, behavioral, emotional, and interpersonal domains. It is possible that TBI patients are at risk to develop self-limiting belief systems as they attempt to interpret the changes associated with their injury. Such belief systems may be characterized by an external locus of control, a helpless or hopeless cognitive style, and poor choice of coping strategies. Without access to interventions aimed at challenging both general and specific cognitive appraisals, the self-fulfilling nature of these belief systems may in turn lead to poor quality-of-life outcomes, reinforcing the belief system, and creating a self-perpetuating negative cycle. In other words, symptoms of TBI in the acute phase may predispose individuals to experience unsuccessful attempts at coping, in turn decreasing their cognitive appraisal of their ability to cope with stressors as well as their beliefs that coping behaviors will result in meaningful outcomes.

### *Overview of Traumatic Brain Injury*

In the United States, an estimated 1.5 to 2 million people incur TBI each year as a result of vehicular accidents, falls, acts of violence, and sports accidents. Nationally, the estimated incidence rate of TBI is 100 per 100,000 persons, with 52,000 annual deaths (NIH, 1998). While the TBI-associated death rate has decreased by 20% from 1980 to

1994 from 24.7 per 100,000 to 19.8 per 100,000 (Center for Disease Control and Prevention [CDC], 2003), the number of people surviving TBI with impairment has increased significantly (NIH, 1998). Whereas the introduction of airbags, random breath testing, and reduced speed limits have decreased the overall number of road fatalities, more effective emergency care, quicker and safer transportation to specialized treatment facilities, and advances in acute medical management have enabled people to survive injuries that previously would have been fatal (Khan, Baguley, & Cameron, 2003). These innovations have presented health-care professionals with a new set of challenges: rehabilitating and reintegrating persons with profound, multi-system and often permanently altered life changes (Moore & Stambrook, 1995). Although it affects people of all ages, TBI is the leading cause of long-term disability among children and young adults. Each year, approximately 70,000 to 90,000 individuals incur a TBI resulting in long-term, substantial loss of functioning (NIH, 1998).

TBI may result in significant impairment of an individual's physical, cognitive, and psychosocial functioning and contribute to family disruption, loss of income and earning potential and considerable expense over a lifetime (Khan, et al., 2003).

Approximately 5.3 million Americans, a little more than 2% of the U.S. population, currently live with disabilities resulting from TBI (CDC, 2001). The estimated average lifetime cost of care for a person with severe TBI ranges from \$600,000 to \$1,875,000. However, these figures do not include the additional costs of social service agencies, law enforcement, courts, or lost earnings of caregivers (NIH, 1998). Annual costs for all TBIs in the United States exceed \$48 billion (CDC, 2003).

Males are twice as likely as females to sustain TBI. The highest incidence of TBI is among persons 15 to 24 years of age and 75 years and older, with a less striking incidence elevation in children ages 5 and younger (NIH, 1998). Approximately 50% of all TBIs are the result of motor vehicle, bicycle, or pedestrian-vehicle incidents. Falls are the second most frequent cause of TBI, particularly among the elderly and very young. Violence-related incidents account for approximately 20% of TBI and are divided equally into firearm and non-firearm assaults. Although sports and recreation-related injuries account for 3% of hospitalizations for TBI, it is estimated that approximately 90% of sports-related TBIs are mild and are likely unreported (NIH, 1998).

The incidence of TBI increases with declining income and with rising population density (Kraus & McArthur, 1999). Although little research exists regarding the rate of TBI in rural areas, a study of rural and urban counties in Iowa revealed a U-shaped pattern of TBI rates, with motor vehicle accidents and falls high among residents of rural counties and falls and assaults high among residents of urban counties. In the same study, the highest percentages of severe TBI were found among residents of the most rural and most urban counties. However, survivors of TBI in rural areas were more likely to be functionally dependent and reported a lower health status than their urban counterparts (Schrootman & Fuortes, 1999). Schrootman & Fuortes (1999) attribute these findings to the lack of post-acute services, such as counseling, day programs, and job training, for survivors of TBI in rural areas. In a study comparing residents of rural and urban counties in Missouri on vocational rehabilitation outcomes following TBI, rural residents were found to have higher rates of multiple TBIs, received less funding, fewer transportation services, less on the job training, and were less likely than urban residents

to be employed at the close of the study (Johnstone, et. al., 2003). In their literature review of acute traumatic injuries in rural areas, Peek-Asa, Zwerling, and Stallones (2004) found increased injury and mortality incidence rates in rural populations, which they attributed to features of rural environments (e.g., roadway design, high-risk industries including mining and agriculture), a lower propensity for rural residents to engage in injury prevention (e.g., wearing seat belts or bicycle helmets), inadequate access to emergency medical services, as well as a lack of rehabilitation services in rural areas. In West Virginia, conservative estimates indicate that each year brain injuries are responsible for 3,600 hospitalizations, 700 deaths, and 600 long-term disabilities (West Virginia Department of Health and Human Services, 2005).

Impairment following TBI may occur in a variety of domains and include physical, cognitive, emotional, and behavioral difficulties. A study of patients one year post severe TBI indicated that 63% continued to display significant cognitive impairments (Kersal, Marsh, Havill, & Sleight, 2001). Recovery seems to take place at a differential rate across cognitive functions, with some impairments potentially remaining several years post injury. Longitudinal analyses have identified challenges to community re-entry following TBI, increasing in accordance with injury severity. A study of long-term outcome of TBI for 76 individuals reported clinically significant levels of depression and anxiety, impaired memory, decreased psychomotor speed, decreased vocational functioning, high divorce rates, decreased social functioning, and increased dependence on others 16 years post-injury (Hoofien, Gilboa, Vakil, & Donovanick, 2001). It has been suggested that permanent cognitive, behavioral, and emotional, and interpersonal changes following TBI may create situations that induce learned

helplessness, deficits in coping, and altered locus of control beliefs, thereby decreasing the extent to which individuals can optimize their recovery (Moore & Stambrook, 1995).

### *Mechanism and Classification of Injuries*

TBI is classified as open or closed depending on the manner in which external forces impact the brain. Open head injuries occur when the meninges have been breached, leaving the brain exposed. Closed head injuries occur when the soft tissue of the brain is forced into contact with the hard, bony, outer covering of the skull (Fuller, 1998). Most non-combat-related head injuries are closed head injuries resulting from falls, assaults, and motor vehicle accidents (1998). Brain damage is caused by tissue compression, tension, shearing, or a combination of these mechanisms. Brain injuries are coup (injuries at the site of impact) or contrecoup (injuries distant from the site sustaining impact) (Winkler, 2001). Primary damage to the brain is the result of forces exacted on the brain at the time of injury (Fuller, 1998), and may result in skull fractures, contusions of the gray matter, and diffuse white matter lesions (Winkler, 2001). Secondary damage refers to changes compromising brain function that result from the brain's reaction to trauma or other system failure (Fuller, 1998), and may involve brain swelling, intracranial hematoma, cerebral hypoxia, and ischemia (Winkler, 2001). Although the long-term effects associated with TBI vary depending on the type and severity of the injury, differences in recovery are seen in persons who appear to have identical injuries (Fuller, 1998).

*Determining the Severity of TBI*

Both in the acute stage and later rehabilitation, management is individualized to the person's particular pattern of deficits or disabilities identified through medical imaging and neuropsychological assessment. However, broad categorization of injury severity is commonly determined through evaluation of post-traumatic amnesia (PTA), Glasgow Coma Scale score, or duration of unconsciousness (Khan, et al., 2003). Post-traumatic amnesia refers to the time between the injury and recovery of continuous memory which ends when the patient becomes lucid and clearly remembers recent conversations and events (Bond, 1990). Criteria for utilizing PTA to classify TBI severity are as follows (Jennett & Teasdale, 1981):

Less than 5 minutes: very mild

5 to 60 minutes: mild

1 to 24 hours: moderate

1 to 7 days: severe

1 to 4 weeks: very severe

More than 4 weeks: extremely severe

The Glasgow Coma Scale is the most widely used scale for assessment of disordered consciousness in the period following head injury and is also used as a means of predicting early outcome of injury (Bond, 1990). Coma is defined as an inability to open the eyes, an inability to obey commands, and an inability to utter understandable words. The Glasgow Coma Scale yields a score ranging from 3 to 15 points comprised of a patient's eye opening response, best motor response, and verbal response (Jennett & Teasdale, 1981). Although the Glasgow Coma Scale is typically used to provide a

prognosis of survival rather than functional outcomes, it has been used as a means for classifying TBI severity. Patients with scores of 8 or less are classified with severe injuries; scores of 9 to 11 are classified as moderate injuries; and scores of 12 or higher constitute minor injuries (Bond, 1990).

Loss of consciousness (LOC) is another method of classifying the severity of TBI. A mild injury usually results in LOC of less than 30 minutes; moderate injuries up to 24 hours; and severe injuries may have LOC greater than 24 hours (Kraus, 2002). During standardization of the Neurobehavioral Functioning Inventory, an instrument measuring the frequency of behavioral difficulties reported by individuals with TBI and their family members, Kreutzer, Seel, and Marwitz (1999) identified three subgroups of TBI severity based on the number of days an individual was unconscious: unconscious less than or equal to one hour, unconscious greater than one hour and less than 14 days, and unconscious equal to or greater than 14 days. The three groups differed significantly in the frequency of difficulties reported in the somatic, memory/attention, communication, and motor domains.

Studies vary with respect to which indicators of TBI severity are the best predictors of impairment. Brooks (1990) found a step-wise deterioration in memory performance when patients with PTA of short (0-7 days), medium (8-27 days), and long (more than 27 days) duration were compared. Although variances were high, some patients with very long duration PTA performed well and others with short duration PTA performed poorly. Brook's (1990) examination of several PTA studies suggests that there may be a threshold effect for the predictive utility of PTA, such that patients with PTA of 2 weeks or less show great variability in cognitive performance. As PTA increases, the



predictability of cognitive deficits also increases. Mandleger and Brooks (1975) found that PTA may only be predictive of cognitive performance in acute stages of injury. In their study examining the performance of individuals with severe TBI on the Wechsler Adult Intelligence Scale, PTA was a good predictor of verbal IQ up to 6 months post injury and a good predictor of performance IQ up to 12 months post injury. Based on this body of research, Brooks (1990) concluded that “a coping, resourceful personality, high drive, and supporting social milieu may compensate for even a very long PTA” (p. 168).

Similarly, in his review of the literature regarding the predictability of Glasgow Coma Scale categorization on cognitive outcomes, Brooks (1990) found a greater likelihood of continuing cognitive deficit for patients in the “severe disability” category when compared with those in the “moderate disability” or “good recovery” categories. However, Brooks (1990) noted considerable overlap on cognitive scores for patients in the “moderate” category with those in the remaining two categories, with some patients in the “severe” category displaying average memory functioning and some patients in the “good recovery” category displaying severe memory deficits. Furthermore, Glasgow Coma Scale categorizations were found to be more predictive of cognitive outcome soon after injury rather than several months following injury. According to Brooks (1990),

“it may be that during the early period, outcome scale categorization and cognitive performance are heavily dependent on severity of injury, whereas later, both psychological test performance and outcome scale categorization become much more multidetermined, with factors such as injury severity, focal neurologic deficit, affective, social, and behavioral status of the patient all contributing to the categorization” (p. 169).

It is estimated that 70 to 85 % of all traumatic brain injuries fall into the mild category. While individuals with mild TBIs rarely require inpatient rehabilitation, many report cognitive and behavioral changes from which they recover within 3 to 6 months. However, 10 to 15 % remain symptomatic in the longer term with a persisting post-concussive syndrome (Khan, et al., 2003). Mild traumatic brain injury is characterized by alteration of consciousness or loss of consciousness, any loss of memory for events immediately before or after the accident, any alteration of mental state at the time of the accident, as well as neurological deficits that may or may not be transient (Ruff & Jurica, 1999). Neurological testing may reveal difficulties in the areas of attention and memory and individuals may experience becoming fatigued more easily, disordered sleep, headache, vertigo or dizziness, irritability or aggression with little or no provocation, anxiety, depression, affective lability, personality changes, apathy, or lack of spontaneity (1999). Although most individuals with mild TBI are able to resume normal social functioning and return to work, some individuals with mild TBI may face years of impairment across domains (Khan, et al., 2003).

Individuals with moderate TBIs may be independent, but experience some degree of disability (Fuller, 1998). Moderate TBI includes PTA of one to 24 hours (Jennett & Teasdale, 1981) and a Glasgow Coma Scale score of 9 to 11 at the time of initial evaluation (Bond, 1990). However, patients in the moderate category show a broad range of possible outcomes, and it is generally not possible to predict the extent of recovery in the initial weeks following the trauma (Khan, et al., 2003). Limitations to normal functioning levels may include balance problems, paralysis, weakness, seizures, memory

deficits, poor judgment and problem solving, behavioral problems, and language difficulties (Fuller, 1998).

Severe TBI results from significant neurological damage that causes PTA of greater than 1 day (Jennett & Teasdale, 1981) and a Glasgow Coma Scale score of 8 or less at initial evaluation (Bond, 1990). Most individuals sustaining a severe TBI require extensive hospitalization, a long period of rehabilitation, and are likely to become permanently disabled due to severe cognitive, behavioral, physical, and perceptual deficits (Fuller, 1998). Nevertheless, diagnosis of severe TBI does not preclude individuals from making meaningful recovery or progress.

In a study examining the predictive validity of the Glasgow Coma Scale score, length of unconsciousness, and PTA, significant correlations between all three severity measures and employment outcome were found for individuals with mild, moderate, and severe TBI. Despite these findings, many individuals classified with severe TBI were working independently or in subsidized employment 5 years post injury (Asikainen, Kaste, & Sarna, 1998). These findings suggest that although injury severity is predictive of outcome, severe TBI is not necessarily incompatible with good recovery or capacity for employment years later. Similarly, in a study comparing improvement in performance on a full neuropsychological battery for individuals classified with moderate to severe TBI between 6 months and 2 years post injury, Lannoo, Corlardyn, Jannes, and De Soete (2001) found considerable variability in performance within the group of participants classified with severe TBI. Despite comparable scores on a baseline impairment index, as well as matched lengths of PTA and coma length, two distinct recovery groups emerged from the initial severe TBI group, with one group showing

marked improvement over a 2-year period and the other group showing very little improvement. These results suggest the need for additional research examining factors beyond severity ratings underlying differences in neuropsychological recovery for individuals with severe TBI.

### *Consequences of TBI*

The consequences of TBI are rarely limited to one set of symptoms, difficulties, or impairments that affect only one aspect of an individual's life. Rather, the consequences of TBI are complex and involve interrelationships between physical, cognitive, emotional, and behavioral symptoms which influence an individual's interactions with family, friends, and the community (NIH, 1998). In many cases, the symptoms of TBI endure in original or altered forms across the lifespan, with new problems likely to occur as a result of new challenges (1998). Determining the combination of cognitive, behavioral, and physical deficits following TBI is an important first step in setting goals for rehabilitation (Khan, et al., 2003).

The neurological consequences of TBI are complex, occurring throughout the neural axis. Any sensory, motor, or autonomic function may be compromised resulting in physical challenges. Most of these complications become apparent in the first days or months following injury, depending on the severity of the trauma (NIH, 1998). Motor function impairment may involve disordered coordination, balance, walking, hand function, or sleep. Motor disturbances resulting from head injury generally have a good prognosis. Dysfunctions in the cerebral hemispheres and of the cranial nerves are among the most common disorders encountered and may partially resolve (Winkler, 2001). Sensory loss may be present in the areas of taste, touch, hearing, vision, or olfaction

(Khan, et al., 2003). However, cranial nerve damage involving hearing, vestibular function, and smell tends to be more permanent (Winkler, 2001). Other long-term sequelae may include seizures, headaches, sleep disorders, or sexual dysfunction (NIH, 1998).

A wide range of cognitive impairments is apparent following TBI, and these deficits can have a greater impact on the individual's overall level of psychosocial functioning than physical impairments (Kersel, Marsh, Havill, & Sleight, 2001). Common cognitive deficits following TBI produce a myriad of functional problems and include disturbances in arousal, attention and concentration, memory, language use and visual perception, as well as abstract reasoning and complex problem solving (Kraus, 2002). In a study assessing the simple and complex attention, verbal memory, executive functioning, and perceptual reasoning of 65 adults with severe TBI, Kersel, et al. (2001) found that 74% of the participants displayed some degree of cognitive impairment 6 months post injury, with 63% continuing to display cognitive impairment 1 year post injury. At both testing times, impairment was most frequently observed in the areas of verbal memory, complex attention, and executive functioning. Although some improvement was noted across measures between 6 months and 1 year, degree of recovery across cognitive domains differed, with more complex functions displaying a slower recovery.

Disturbances in higher level or executive functions are fairly common following TBI due to the high percentage of individuals with frontal lobe involvement. Executive functions may be related to other cognitive processes including attention and memory and involve planning, sequencing, judgment, mental flexibility, abstract reasoning, complex

problem solving, inhibition, and emotional self-regulation (Kraus, 2002; Fuller, 1998). Impaired executive functioning is particularly problematic for TBI rehabilitation because the nature of frontal lobe injury is characterized by a lack of awareness related to the accompanying cognitive, emotional, and behavioral symptoms and can impair the individual's ability to recognize the impact of their deficits on ability to function in daily activities and to benefit from rehabilitation (Port, Willmott, & Charlton, 2002). In a study examining the relationships between psychological and neuropsychological factors underlying deficits in self-awareness and self-regulation for 61 individuals with moderate to severe TBI, Ownsworth, McFarland, and Young (2002) found that impaired executive functioning was the strongest predictor of low self-awareness. However, the use of denial as a coping strategy was associated with lower levels of motivation or readiness to change (2002). These findings suggest that both neuropsychological and psychological processes are interactive factors underlying self-awareness for individuals with TBI.

In a study of 30 individuals with moderate to severe TBI involved in a memory rehabilitation program less than 6 months post injury and their significant others, Port, et al. (2002) found that both TBI patients and their family members displayed some lack of awareness related to cognitive deficits, reporting only low to moderate levels of difficulty. However, TBI patients were significantly less likely than their family members to acknowledge difficulties related to executive functioning, suggesting lack of insight with regard to this cognitive domain. It may be that perceiving changes associated with TBI is particularly difficult for both patients and family members soon after injury. In a study of 50 individuals with moderate to severe TBI and their family members, 40% of TBI patients and 34% of significant others reported symptoms of mild

or greater depression and 54% of TBI patients and 39% of their significant others reported symptoms of mild or greater anxiety (Wallance & Bogner, 2000). A significant relationship was found between awareness of deficits and psychological distress for individuals with TBI, such that those who reported fewer symptoms of depression and anxiety were more likely to consider themselves as less impaired than reported by their significant others. Conversely, individuals with TBI who reported more symptoms of depression and anxiety were more likely to be in agreement with their significant others regarding their level of impairment or to report more deficits than did their significant others (2000).

A variety of behavioral and personality changes have been reported following TBI and are related to significant disruption of social outcomes and rehabilitation efforts (Kraus, 2002). These changes may include irritability, lability, impulsivity, disinhibition, aggression, poor motivation, poor self-regulation of behavior, lack of goal-directed behavior, poor judgment and insight, risk taking, or sexual disturbances (Fuller, 1998; Kraus, 2002; Rosenthal & Bond, 1990). Though no definitive answer has yet been given as to which factors are responsible for personality disturbances after head injury, the general assumption is that behavioral disturbances following head injury are multifactorial in etiology. Rosenthal and Bond (1990) suggest that behavior following TBI is the product of the interaction of the individual's pre-injury intellect, personality, and social behavior with the physical, cognitive, and emotional effects of the injury and the nature of the individual's social environment.

A variety of social consequences may result following TBI including increased risk of chronic unemployment, inadequate academic achievement, economic strain and

financial hardship, lack of transportation alternatives, inadequate recreational activities, substance abuse, difficulties in maintaining interpersonal relationships, divorce, and the loss of pre-injury roles (Khan, et al., 2003; NIH, 1998). In a study examining long-term outcome of severe TBI for a group of 76 individuals approximately 14 years post injury, Hoofien, Gilboa, Vakil, and Donovan (2001) found that participants reported being seriously affected by significant levels of depression, anxiety, and hostility as well as disrupted familial and social relationships as compared to being moderately affected by cognitive deficits, impaired vocational functioning, and difficulties with activities of daily living. Both participants and family members rated social functioning as the most impaired domain, with 31% of individuals reporting no friendships and 8% reporting complete social isolation. In addition, family members reported a high sense of burden, a finding consistent with previous research suggesting that relatives' stress and sense of burden increase over time (2001).

Spiraling adverse consequences associated with the loss of independence are particularly distressing for individuals with TBI and their significant others and result in overall disruption of family functioning (NIH, 1998). Rosenthal and Bond (1990) suggest that dependency issues for TBI individuals are rooted in low self-confidence and indicate that such anxiety is best reduced with intensive treatment that aims to provide a structured daily routine, the mastery of which restores feelings of self control and self confidence.

### *Community Integration*

The International Classification of Functioning, Disability, and Health (ICF) provides a useful framework for considering the complexity of TBI assessment and



rehabilitation through emphasizing the importance of participation despite impairment (World Health Organization [WHO], 2001). The ICF is a classification and description of health domains which groups functioning into three domains. The body component is a construct which addresses the functional and structural integrity of body systems while considering duration of condition and developmental stage of the individual. The activities domain represents the performance of individuals in activities within the context of their culture. The participation domain involves the nature and extent of a person's involvement in life situations in relation to impairment, activities, health conditions, and contextual factors (2001). In other words, according to the ICF, an individual's engagement and willingness to participate in available culturally appropriate activities has as much significance in relation to disability status as does physical functioning.

The ICF framework is consistent with a community integration approach to evaluating rehabilitation outcomes for individuals with TBI. Community integration is generally defined as the effectiveness of performing daily activities and engaging in social roles that are valued by the person or his or her socio-cultural environment according to his or her characteristics (Dumont, Gervais, Fougereyrollas, & Bertrand, 2004). Congruent with this definition, interviews of 116 people with moderate to severe brain injuries regarding their perspectives on community integration revealed that orientation, acceptance, conformity, close and diffuse relationships, living situation, independence, productivity, and leisure were perceived to be important components of community integration. These nine indicators of community integration were classified according to four factors: general integration, social support, occupation, and independent

living (McColl, et al., 1998). Interventions that are focused on improving the level of community integration for individuals with TBI have been described as those:

. . . designed to lessen the impact of cognitive disability on real world status and functioning by engineering the individual's environment to reduce the impact of cognitive disability and modifying the expectations and supportive behavior of everyday people in the individual's life (i.e., providing education, training, problem solving, and other forms of support) (Ylvisaker, Hanks, & Johnson-Greene, 2002, p. 196).

Emphasizing community integration as a central focus of treatment represents a break from traditional TBI rehabilitation approaches. Strongly rooted in a medical model, traditional TBI rehabilitation has focused on restoring physical function or improving a specific cognitive function (Minnes, et al., 2003). The medical model's tradition of narrowing the focus solely to issues of the impact of health/pathology on the person has been criticized for ignoring factors within the person that are known to shape his or her actions, perceptions, primary values, and goals (Brown, Gordan, & Haddad, 2000). The consensus panel of the NIH Consensus Development Conference on Rehabilitation of Persons with Traumatic Brain Injury noted that adhering to the narrow focus of current medical restoration approaches is a major limitation within the field of TBI rehabilitation, and indicated a need for new models of rehabilitation which emphasize the parallel importance of environmental modification in order to create enabling conditions for individuals with TBI (NIH, 1998).

Rehabilitation programs focused on community integration are generally in consensus that the goal of rehabilitation after TBI involves the resumption of effective

functioning in the home and social environment, even though it may not be possible to eliminate specific neurological, cognitive, or functional impairments (Cicerone, 2004). In his attempt to examine whether TBI rehabilitation produces clinically meaningful change for patients, Cicerone (2004) utilized the Community Integration Questionnaire (CIQ) scores from three outcome studies to collapse the data and examine the number of individuals showing clinically significant change following rehabilitation. Of 148 individuals with moderate to severe TBI who received some form of comprehensive, post-acute neuropsychological rehabilitation approximately 1 ½ years post injury, 42.6% demonstrated clinically significant improvement on the CIQ, 51.3% did not show clinically significant change, and 6.1% showed a clinically significant decline on the CIQ. For comparison purposes, Cicerone (2004) analyzed data for 21 patients who did not receive any post-acute rehabilitation, revealing that 24% of these patients showed clinically significant improvement and 24% showed a clinically significant decline on total CIQ scores. Based on these analyses, Cicerone (2004) concluded that TBI rehabilitation may have some benefit in producing improvements in community functioning, but it may also prevent significant decline in functioning for a significant number of patients. Cicerone (2004) suggests that the analysis of community integration scores based on clinically significant individual change in scores may represent an important alternative to group comparisons with regard to describing individual variability in rehabilitation outcomes. In other words, identification of patients showing clinically significant change may be a productive approach to identifying patient characteristics and other factors related to rehabilitation effectiveness.

Although cognitive rehabilitation programs designed to improve attention and concentration, improve memory and other cognitive abilities, provide life skills training, and teach coping strategies have conducted evaluation studies seeking evidence that cognitive rehabilitation facilitates better functional outcomes, these have been criticized for weak research methodology (Goranson, Graves, Allison, & La Freniere, 2003). In a large-scale review of studies that contained data relevant to evaluating the effectiveness of TBI rehabilitation programs, 600 articles were found relevant to determining whether application of cognitive rehabilitation improved outcome for individuals with TBI. Of these articles, only 15 reported results of studies that included a control group. Of these 15 articles, only six reported results for direct outcome measures (e.g., measures of health or employment status) rather than indirect measures (e.g., cognitive status on psychological tests). Of these six studies, only two showed significant results, and those two had very small sample sizes ( $n=4$  and  $8$ ) (Carney, Chestnut, & Maynard, 1999). Goranson, et al. (2003) indicate an ongoing need for research on the efficacy of rehabilitation programs with cognitive components which use sample sizes of at least 20, utilize no-treatment control groups, utilize a pre-test-post-test design, and direct rather than indirect outcome measures.

### *Coping Following TBI*

Successful return to the community is influenced by how a person copes with the stress associated with integration. Coping has been defined as the “constantly changing cognitive and behavioral efforts to manage specific external and/or internal demands that are appraised as taxing or exceeding the resources of the person” (Lazarus & Folkman, 1984, p. 141). Coping serves three main functions. Problem-focused coping can change

the situation out of which stressful experiences arise; perception-focused coping can control the meaning of experiences before they become stressful; and emotion-focused coping can control the emotional reaction to the stressor after it has emerged (Karlovits & McColl, 1999). Problem-focused strategies are more probable when it is perceived that the problem is amenable to change. In contrast, perception-focused and emotion-focused are more likely when it has been perceived that nothing can be done to modify a stressful situation that is perceived as harmful, threatening, or challenging (1999). According to this perspective, perception and emotion-focused strategies should be more likely in the event of that a situation is perceived to be uncontrollable, such as in the case of permanent disability.

In a qualitative study of 11 adult inpatients in a TBI rehabilitation program, aimed at identifying stressors associated with community integration and corresponding coping strategies, Karlovits and McColl (1999) found that problems with general integration, decreased independence, social support, and occupation were the most commonly reported stressors experienced by participants. Problem-focused coping strategies were the most common type of coping reported in response to these stressors, suggesting that individuals perceived an ability to change stressful situations. It may be that problem-focused forms of coping are consistent with the goals and values of TBI rehabilitation, which teach individuals that positive outcomes are controllable, thereby explaining the predominant use of this strategy. Emotion-focused coping strategies were the least reported strategy, with substance use as the only strategy that could be categorized as emotion-focused.

There is some evidence to suggest that problem-focused forms of coping are associated with more positive emotional outcomes following TBI. In a study of 175 individuals with mild, moderate, and severe TBI 1-8 years post-injury, Moore and Stambrook (1994) found that resignation, escape, and denial were generally associated with higher levels of emotional distress. Similarly, in a study comparing coping strategies and associated emotional outcomes for individuals with TBI and orthopedic patients, Curran, Ponsford, and Crowe (2000) found no differences in coping strategies between the two groups. However, coping strategies focusing on problem solving were related to lower anxiety levels for both TBI and orthopedic participants, whereas coping strategies characterized by worry, wishful thinking, and self-blame were associated with higher levels of depression and anxiety in both groups. It may be that beliefs related to an individual's ability to exert control over rehabilitation outcomes is an important determinant of successful coping.

In a study comparing individuals with TBI from both violent and accidental etiologies, no significant relationship was found between self-blame and external circumstances (Hart, Bogner, & Whyte, 2003). It is possible that self-blame for an injury reflects a general tendency to take responsibility for events in one's life. Hart, et al. (2003) suggested that participants' self-blame might have been part of a coping strategy that resulted in creating meaning for the event or helping the injured person to marshal internal resources for dealing with its consequences. Since the study was conducted with participants in the acute phase of TBI, analyses of the manner in which blame attribution related to rehabilitation outcomes were not completed. The researchers suggest that

future research warrants examining relationships between blame attribution, general coping ability, and locus of control for individuals with TBI (2003).

*Self-Efficacy, Locus of Control, and Chronic Illness*

According to the transactional model of stress by Lazarus and Folkman (1984), distress experienced in relation to an illness is the end result of a person's dynamic transaction with the environment, and depends on the severity of the illness and the individual's cognitive appraisal and reappraisal of control over events and circumstances. Folkman (1984) considered locus of control and general self-efficacy as appraisal variables within stress and coping theory, with generalized control beliefs influencing task specific self-appraisal under novel conditions. Although few studies regarding the relationship between self-efficacy or locus of control and therapeutic outcomes have been conducted with TBI populations, research with a variety of chronic illness populations supports this theoretical approach.

Several studies have examined the relationship between Albert Bandura's efficacy theory and rehabilitation. According to Marks (2001), a lack of belief in one's ability to manage pain and to function despite it might further reinforce debilitating health behaviors for individuals suffering from chronic arthritis. He proposed that "an ensuing spiral of inactivity, along with the decreased social, economic, and psychological rewards which might accompany this, might further impair self judgments and self confidence for arthritis patients, regardless of any actual disease 'flare up'" (2001, p. 272). A study of 229 out-patients with rheumatoid arthritis of at least five years found that individuals who had higher self-efficacy scores displayed fewer pain behaviors, such as limps, facial grimaces, and guarded movements. This effect remained after controlling for disease

activity and demographic variables, suggesting that pain behaviors exhibited by people with rheumatoid arthritis might be more strongly related to their levels of personal self-efficacy than to their disease severity (Buescher, et al., 1991). In the same study, researchers found that fatigue levels were favorably influenced by adopting high self-efficacy expectations towards coping with the disease (1991). It may be that positive self-appraisal facilitates the use of adaptive strategies for managing disease symptoms.

Hellstrom, Lindmark, Wahlberg, and Fugl-Meyer (2003) examined the relationship between fall self-efficacy, balance and motor function, and the ability to perform activities of daily living in a group of 37 elderly stroke patients. Falls self-efficacy was strongly correlated with all objective measures of functioning, including balance, motor function, walking ability, and activities of daily living during the acute phase following stroke. Fall self-efficacy had the highest explanatory value for activities of daily living 10 months after stroke. Furthermore, at the 10-month follow-up individuals in the low self-efficacy group showed a decline in motor function and balance, while the high self-efficacy group had increased their motor function and balance despite no significant differences in motor function between these groups at initial assessment. Hellstrom, et al. (2003) conclude that after an acute event, high self-efficacy may help patients to regain their ability to perform activities of daily living, resulting in less functional decline from their premorbid levels compared with individuals with low self-efficacy. These findings support the premise that self-efficacy may mediate the impact of physiological variables on functioning following debilitating illness.

Kohler, Fish, and Greene (2002) examined the hypothesis that perceived self-efficacy mediates the effects of biomedical variables on quality of life for individuals



with chronic obstructive pulmonary disease (COPD). A group of 208 adults with COPD completed measures of overall health status, lung function, severity of respiratory symptoms, self-efficacy for coping with shortness of breath and performing functional activities, as well as impairment across a variety of daily activities. Path analysis results indicated that the association of pulmonary function and symptoms with functional impairment was mediated by perceived self-efficacy for functional activities. In other words, patients with low self-efficacy for carrying out functional activities were more limited in function than those with equally severe COPD who had higher self-efficacy. Kohler, et al. (2002) conclude that psychosocial variables may have a stronger influence than biomedical variables on quality of life in pulmonary patients and recommend that both psychosocial and biomedical strategies be considered to provide optimal assessment and treatment to individuals with chronic illness.

In a randomized controlled study of 47 individuals with moderate to severe knee joint disease participating in an 8 week walking program, Allegrante, Kovar, Mackenzie, Peterson, and Gutin (1993) examined the rehabilitative effects of efficacy-building interventions. To enhance participants' self-efficacy and task mastery, all were exposed to four primary experiential sources believed to underpin self-efficacy: repetitive but achievable performance accomplishments, vicarious experiences including modeling of prescribed behaviors, social persuasion including reinforcing feedback, and correct interpretation of their internal physiological states. Compared to the 45 control patients, patients in the walking education and self-efficacy enhancing program experienced clinically meaningful improvements in functional status, as measured by their changes in percent walking distance (1993). In addition, significant positive effects were obtained in

the experimental participants' subjective perception of their physical ability as indicated by the physical activity subscale of the Arthritis Impact Measurement Scale (AIMS). These findings support the use of ecologically-based interventions in increasing positive belief systems and subsequent functional outcomes.

Norman & Norman (1991) examined the relationship between health locus of control beliefs and progress in rehabilitation for a group of 93 patients admitted to a mid-western rehabilitation facility. Participants ranged with regard to medical diagnoses, and all required a variety of inpatient rehabilitation. The study concluded that those individuals who believed in internal health locus of control progressed in rehabilitation significantly more than those who believed in powerful others or chance locus of control (1991). Similarly, in a study of 250 ambulatory patients of a VA Outpatient clinic suffering from a variety of chronic illnesses including diabetes, hypertension, emphysema, asthma, and bronchitis, Nagy and Wolfe (1983) found a significant relationship between illness symptoms and low internal locus of control. Although there were no significant differences among patients with regard to their medical histories, with participants having spent an average of 7.9 months in the hospital and received treatment for their primary medical problem an average of 18.8 years, those with lower internal locus of control beliefs reported significantly more symptoms associated with their illness. However, Nagy and Wolfe (1983) caution that care should be taken not to imply causality from health locus of control beliefs, since the relationship noted in their study is purely correlational.

Johnston, Morrison, Macwaller, and Partridge (1999) examined the relationship between control beliefs and recovery from disability for a group of 71 stroke patients at 3

weeks, 1 month, and 6 months post-stroke. Neither age nor site of the lesion predicted recovery from disability at 6 months. However, perceived control, measured by the Recovery Locus of Control scale, predicted recovery from disability at follow-up. Although stroke severity, measured by the Orgogozo Neurological Index, was predictive of disability at 6 months, perceived control accounted for significantly more variance. Johnston, et al. (1999) suggest that interventions which increase perception of control may be beneficial for stroke recovery.

Cvengros, Christensen, and Lawton (2005) note that despite a body of research supporting a relationship between locus of control beliefs and outcome related to chronic illness, these studies are unable to address the issue of whether previously assessed locus of control beliefs are predictive of subsequent changes in adjustment over time. The extent to which individuals facing a chronic illness are able to shift perceptions in light of disease progression may be an important determinant in adaptation. In a study of the relationship between locus of control beliefs and depression for 207 individuals with chronic kidney disease, Cvengros, et al. (2005) obtained data for participants to establish baseline locus of control beliefs and levels of depression and at a 16-month follow-up. Regression results indicated that baseline internal locus of control was not a significant predictor of depression at follow-up. However, increases in internal locus of control over the 16-month follow-up were significantly predictive of decreased depression at follow-up. Furthermore, internal locus of control was most predictive of lower depression for those individuals whose illness had progressed to the point of requiring dialysis treatments (2005). These findings support the importance of cognitive belief systems as individuals attempt to adapt to and cope with progressive uncontrollable illness.

Several studies have addressed the relationship between self-efficacy and locus of control beliefs as they relate to outcome following illness. A study of 218 undergraduate students examining the interaction between external health locus of control, self-efficacy, and illness severity in relation to distress found that external health locus of control combined with self-efficacy moderate illness-related psychological distress (Shelley & Pakenham, 2004). Specifically, chronic illness was associated with increased distress compared with acute illness. High levels of self-efficacy were negatively correlated with distress for individuals with both chronic and acute illness. Although external locus of control was not independently related to distress, a three-way interaction between illness severity, external health locus of control, and self efficacy was found, such that high external locus of control, high self-efficacy, and acute illness were associated with the lowest levels of distress. In contrast, high external locus of control, low self-efficacy, and chronic illness resulted in the highest levels of distress (2004). The researchers hypothesize that high external locus of control may reduce distress for individuals with acute illnesses, which often require immediate hospital treatment and a strong belief in the control of doctors, because the patient has little opportunity to exert control. When the situation demands internal control, as in the case of chronic illnesses, a reduced reliance on external control is more adaptive (2004).

In a study examining the associations among self-efficacy, health locus of control, and psychological distress in 159 elderly Chinese women suffering from chronic illness, Wu, Tang, and Kwok (2004) found that internal health locus of control was significantly correlated with general self-efficacy, whereas external health locus of control was unrelated to self-efficacy. However, results from hierarchical regression analysis indicated

that health control beliefs did not interact with general self efficacy, but that these two variables had exerted their main effects on participants' negative mental health status (2004). Psychological distress was best predicted by a low level of general self-efficacy as well as a high level of external locus of control. Interestingly, internal health control beliefs did not contribute to the prediction of distress. Wu, et al. (2004) attributed these findings to the possibility that the direct effect of internal control beliefs may be mediated by general self-efficacy beliefs since these constructs were related to each other.

Schiaffino and Revenson (1992) examined mediator and moderator effects of self-efficacy and locus of control beliefs as they relate to adaptation to chronic illness for a group of 64 adults being treated for rheumatoid arthritis. A mediator is a variable that accounts for the relation between a predictor and a criterion variable, such that self-efficacy beliefs could be thought of as explaining the relationship between perception of control over an event and successful adaptation (1992). In contrast, a moderator is a variable that affects the direction and/or strength of the relation between a predictor and a criterion variable. The relationship between perceived control and self-efficacy would be one of moderation if the relationship of self-efficacy to adaptational outcomes were positive under conditions of high control and negative or zero under conditions of low control (1992). In testing these relationships, Schiaffino and Revenson (1992) found that perceived control was found to be related to disability as well as to self-efficacy. Self-efficacy was related to lower disability after partialing perceived control. Controlling for self-efficacy, the relationship between perceived control and disability was not significant. In other words, support was found for the mediational hypothesis, such that

self-efficacy appeared to mediate the relationship between perceived control and disability following rheumatoid arthritis (1992).

In a study comparing a group of 137 individuals with acute illness with a group of 137 individuals with chronic illness on their reported self-efficacy and locus of control beliefs, Endler, Kocovski, and Macrodimitris (2001) hypothesized that individuals with chronic illness would report lower levels of perceived control than those with acute illnesses. Contrary to their hypothesis, there were no differences between the chronic and acute groups on perception of control over their illness. However, participants with chronic illnesses reported significantly lower levels of general self-efficacy than those with acute illnesses (2001). These findings support the premise that self-efficacy beliefs may be more proximal to the consequences of chronic illness, whereas locus of control beliefs exert their influence as a more distal variable. According to Rotter (1972), control appraisals are largely influenced by the individual's previous history of reinforcement. It may be that a variety of reinforcement-behavior interactions, beyond those directly attributed to illness, influence generalized control expectancies. In spite of no significant differences between individuals with acute and chronic illness in terms of their control beliefs, Endler, et al. (2001) found that higher levels of perceived control were positively related to well-being. It appears that both self-efficacy and locus of control beliefs may have significant implications for recovery from illness.

### *Self-Efficacy and TBI Populations*

Little research currently exists examining the impact of self-efficacy on rehabilitation outcomes for individuals with TBI. However, existing studies suggest that patients' self-appraisal of coping ability is a robust area of research in the field of TBI

rehabilitation. Dumont, Gervais, Fougereyrollas, and Bertrand (2004) investigated resiliency factors related to social participation for a group of 53 individuals with moderate TBI who were between 1 and 5 years post injury residing in or near Quebec City. Social participation was defined as effectiveness in performing daily activities and social roles valued by the person or his or her sociocultural environment. Utilizing a multiple regression equation in which social participation was the dependent measure and self-efficacy, self-acceptance, anxiety, autonomy, relationships with others, emotional stability, dynamism, and will were the independent variables, the researchers found that being directed toward goal achievement (dynamism), having high levels of self-efficacy, and determination (will) accounted for 51% of the variance in social participation (2004). Complementary analyses revealed that dynamism and perceived self-efficacy were strongly associated (Pearson correlation coefficient,  $r = 0.83$ ). Further, the perceived self-efficacy and dynamism of people who identified will as a factor improving social participation were higher than those who did not identify will as an influencing factor, suggesting that the 3 constructs are related (2004). It may be that belief in one's ability to engage in daily activities and valued social roles increases motivation and approach coping strategies, thereby increasing opportunities for improving social participation.

Dumont, et al. (2004) suggest that their findings have implications for TBI rehabilitation, noting that perceived self-efficacy and will could be the targets of rehabilitation and social integration interventions. Based on Bandura's (1977) claim that the most influential source in the formation of self-efficacy beliefs is the interpreted result of one's previous performance or mastery experience, the researchers indicate that

programs utilizing ecological intervention models would be most appropriate for such interventions and suggest the need for outcome studies in this regard (2004).

In a study of 45 adults with mild to moderate TBI engaged in an outpatient cognitive rehabilitation program, Rath, Hennessy, and Diller (2003) examined the relationships between problem solving ability and community integration. Individuals with TBI and a comparison group of non-injured individuals were administered traditional neuropsychological instruments for assessing problem solving (Wisconsin Card Sorting Test and the Social Problem-Solving Performance Measure) as well as the Problem Solving Inventory, a measure examining individuals' confidence in their ability to engage in problem-solving, individuals' belief in their ability to exert control over their emotions and behavior while problem-solving, as well as their reported tendency to approach or avoid different problem-solving activities. Individuals with TBI demonstrated poorer problem solving than non-injured comparison participants on traditional neuropsychological measures of problem solving, but performance on such measures was not found to be significantly related to community integration. However, problem solving self-appraisal was significantly associated with participants' community integration level and accounted for 21% of the variance in community integration when entered as the second step in a hierarchical regression equation (2003). Rath, et al. (2003) concluded that self-appraisal of problem solving ability is particularly useful from a clinical standpoint because it elicits individuals' acknowledgment of functional difficulties and provides a framework for guiding remedial efforts. Further, they suggest that rehabilitation psychologists supplement neuropsychological tests with data from self-



appraisal measures when assessing overall functioning and treatment planning for individuals with TBI.

In a study comparing the effectiveness of a program of holistic, intensive, cognitive rehabilitation with a more conventional rehabilitation program for increasing community integration, Cicerone, Mott, Azulay, and Friel (2004) found that individuals in the intensive cognitive rehabilitation program (ICRP) group exhibited over twice the magnitude of treatment effect on total Community Integration Questionnaire (CIQ) scores than the participants in the standard rehabilitation program (SRP) group. Satisfaction with cognitive functioning, as measured by the quality of cognitive functioning scale (QCOG), was strongly related to participant's level of community integration after treatment, and this relationship was most apparent for those in the ICRP group. The CIQ outcome was best predicted by the QCOG, initial CIQ scores, and treatment program, with this model accounting for slightly more than one third of the variance associated with CIQ outcomes. Cicerone, et al. (2004) concluded that the relationship between satisfaction with cognitive functioning and community integration may reflect participant's perceived self-efficacy regarding their functioning, since improvements in neuropsychological functioning and satisfaction with cognitive functioning were not related to each other, but each contributed positively to community integration after treatment. The researchers suggest that effective TBI rehabilitation must address patients' attitudes and beliefs in addition to their cognitive abilities, as remediation of cognitive abilities may have more generalized effects if it increases self-efficacy beliefs as well as trains cognitive skills (2004).

*Locus of Control and TBI Populations*

Although the locus of control construct has been applied to many illness states in the literature, research related to the relationship between locus of control beliefs and rehabilitation outcomes following TBI has been conducted exclusively by Allan Moore, Michael Stambrook, and their colleagues at the Neuropsychology Research Unit of the Health Science Clinical Research Centre in Manitoba, Canada. The researchers' initial interest in examining cognitive moderators of outcome for individuals with TBI was sparked following a study examining the relationships between the coping patterns, psychological, and physical outcomes of 69 male mild, moderate, and severe TBI patients (Moore, Stambrook, & Peters, 1989). On the basis of cluster-analytic techniques, three groups were formed based on responses from the Ways of Coping questionnaire (WOC-R). Cluster 1 was comprised of individuals who endorsed low overall use of the strategies included on the WOC-R. Cluster 2 was comprised of individuals who endorsed high indiscriminate use of coping strategies. Cluster 3 was comprised of individuals who utilized primarily positive reappraisal and seeking social support as coping strategies (1989). No significant differences were found between the cluster groups for age, months since injury, or GCS score. However, Cluster 2 individuals, who utilized high indiscriminate use of coping strategies, had significantly higher levels of depression, psychosocial difficulties, and residual difficulties following their injury than individuals in Cluster 1 (low WOC-R) and Cluster 3 (positive reappraisal and seeking social support) (1989). Although these findings seem somewhat counter-intuitive, since higher use of coping strategies would seem related to positive adjustment, it is important to note that the WOC-R samples a variety of coping responses regardless of their success in

facilitating positive outcomes, including distancing and escape/avoidance strategies.

Moore, et al. (1989) suggested the possibility that Cluster 1 individuals (low WOC-R) may have been actively denying their disabilities and therefore not actively coping since they perceived no ill effects of their TBI. Nevertheless, the finding that individuals who tended to reappraise their situation in a positive light (Cluster 3) showed good adjustment prompted further research examining cognitive moderators of outcome following TBI.

In a second study, Moore (1989) examined locus of control beliefs, attributional style, and coping behaviors in a sample of 62 males with TBI to determine the effect of injury severity and potential moderating effect of cognitive beliefs and coping on long-term adjustment following TBI. Although injury severity was significantly related to long-term outcome, such that individuals with more severe TBI had poorer outcomes, injury severity was unrelated to cognitive beliefs. Moore (1989) found that, regardless of injury severity, individuals who endorsed indiscriminate use of coping strategies, external locus of control beliefs, and negative attributional style for negative events had poorer quality of life status.

A subsequent pilot study utilized Moore's (1989) data to examine the relationship between cognitive factors and vocational status following severe TBI (Lubusko, Moore, Stambrook, & Gill, 1994). Follow-up assessment of belief structure, coping style, and post injury employment status was conducted for the 19 individuals with severe TBI. Lubusko et al. (1994) found that individuals with severe TBI who failed to return to their premorbid level of employment reported significantly lower internal locus of control (as measured by the Multidimensional Health Locus of Control Scale), higher powerful others locus of control (as measured by the Revised Internal-External Scale), and higher

levels of hopelessness (as measured by the Beck Hopelessness Scale) compared to individuals with severe TBI who were able to return to work. Given the split observed with regard to vocational outcome following severe TBI within their sample, with 9 individuals reporting same or improved employment status and 10 individuals reporting worse employment status, the researchers became interested in the possibility that organic factors may be less involved in belief system change than environmental factors in the late stages of TBI recovery.

To test this hypothesis, Moore, Stambrook, and Wilson (1991) examined whether locus of control beliefs were related to injury severity, the relationship between locus of control beliefs and long-term quality of life, and the association of locus of control beliefs with outcome once the contribution of injury severity markers had been removed for a group of 53 patients with moderate to severe TBI. Mildly injured clients were excluded from the study due to difficulties with recruitment and self-selection bias. It was hypothesized that if organic factors proved to influence the belief systems of TBI patients, then differences between severity groups should be seen on measures of cognitive beliefs, such that individuals with severe TBI had higher external and lower internal locus of control beliefs (1991). However, comparison between severity groups revealed no significant differences on measures of locus of control beliefs. Multiple regression techniques were used to compare locus of control measures with GCS score in addition to years of education (as a measure of premorbid intellectual functioning) as predictors of outcome following TBI. Locus of control beliefs accounted for significantly more variance compared to GCS scores and education when predicting long-term psychosocial outcome, such that GCS and years of education accounted for

approximately 1 to 3% of the variance in quality of life while locus of control accounted for an additional 8.7 to 25.5% of the variance in quality of life (1991). Based on these findings, Moore, et al. (1991) concluded that cognitive beliefs may be shaped by factors independent of injury severity, and yet remain associated with long-term outcome.

Despite establishing a strong association between locus of control beliefs and psychosocial outcome following TBI, Moore, et al.(1991) point to the need for studies utilizing methodology beyond that of single measurement design in order to determine whether locus of control beliefs have causal significance as moderators of psychosocial outcome following TBI. Nevertheless, the researchers indicate that locus of control beliefs appear to be more powerfully related to quality of life than initial severity markers late in the recovery process. Since locus of control beliefs are amenable to rehabilitation through establishing a learning history of successful control of reinforcement, Moore, et al. (1991) recommend that new approaches be taken to TBI rehabilitation which maximize the environmental potential for facilitating positive belief systems. Results associated with such approaches to TBI rehabilitation are described as a robust area justifying further study.

In an effort to provide further research support for the clinical utility of new approaches to rehabilitation TBI, Moore and Stambrook (1994) continued to explore the relationships between coping styles and outcome measures for a group of 175 individuals with TBI 1 to 8 years post injury. Congruent with their previous research, Moore and Stambrook (1994) utilized cluster analytic methodology to establish coping styles of individuals with TBI. Three distinct groups emerged from their analysis: Cluster 1 was characterized by low overall use of strategies on the Ways of Coping-Revised

questionnaire (WOC-R). Cluster 2 was characterized by high, indiscriminate use of coping strategies. Cluster 3 was characterized by medium defense and planning and differed from Cluster 2 by lower scores on wishful thinking, fatalism, defense mechanisms, long-term solutions, and planning subscales of the WOC-R (1994). No significant differences were found between the clusters on months post injury, GCS score, or physical difficulties. Individuals in the Cluster 1 (low WOC-R) group were found to report significantly less psychosocial disturbance and mood disturbance than individuals in Cluster 2 (high WOC-R) or Cluster 3 (medium defense and planning). Cluster 3 (medium defense and planning), in turn, reported significantly less mood disturbance than individuals in Cluster 2 (high WOC-R). Moore and Stambrook (1994) concluded that repression, escape, and denial coping strategies among TBI survivors were linked to suboptimal outcomes. They suggest that, together with previous research, these findings indicate the need for interventions based on promoting positive and optimistic appraisal of situations as well as diminishing denial, resignation, and escape for TBI patients in the late stages of recovery (1994).

Finally, Moore and Stambrook (1992) replicated research previously conducted with individuals with spinal cord injury examining the relationship between coping style and locus of control utilizing a sample of 53 individuals with mild, moderate, and severe TBI. Cluster-analytic techniques were used to categorize coping strategies, measured by the Ways of Coping-Revised Scale, and locus of control beliefs, measured by the Multidimensional Health Locus of Control Scale, revealing a two cluster solution. Cluster 1 subjects made significantly less use of the self-controlling and positive reappraisal coping strategies, had significantly higher Powerful Others and Chance locus

of control, experienced significantly greater overall mood disturbance (as measured by the Profile of Mood States), and reported greater physical difficulties (as measured by the Sickness Impact Profile). In contrast, Cluster 2 subjects reported higher use of self-controlling and positive reappraisal coping strategies, lower external locus of control, lower overall mood disturbance, and lower physical difficulties (1992). Although the two clusters did not differ in the number of months post injury or in reports of psychosocial difficulties, Cluster 1 subjects were significantly older and sustained less severe injuries as measured by the Glasgow Coma Scale. Moore and Stambrook (1992) conclude that for patients who have sustained neurological injury, age may play a greater role in later coping efforts and locus of control beliefs than the severity of the initial injury. However, they note the possibility that the greater number of life events and changes experienced by older patients may be a factor removed from the TBI that may, in isolation or in concert, also account for the findings. In either case, Moore and Stambrook (1992) recommend that psychological variables are an important domain for consideration by the health care team in their efforts to use every available resource to ensure maximum quality of life for individuals involved in TBI rehabilitation.

*Research Implications for Locus of Control, Self-Efficacy, and TBI Outcomes*

Based on their research, Moore and Stambrook (1995) propose a conceptual model of cognitive beliefs and appraisals as moderators of outcome following TBI. According to Moore and Stambrook (1995) the TBI patient experiences suboptimal outcomes in cognitive, behavioral, emotional, and interpersonal domains secondary to the early effects of their injury, particularly deficits in executive functioning, which are interpreted by the individual as unrelated to efforts to control the environment. These

early experiences set in motion a self-limiting and self-defeating belief system characterized by external locus of control, learned helplessness, as well as low self-esteem and self-efficacy.

Although their research has primarily examined the relationship between generalized control beliefs, or locus of control, and outcomes following TBI, Moore and Stambrook (1995) acknowledge the overlap between locus of control and self-efficacy, such that:

“... generalized expectancies of external locus of control, and a stable and global attributional style for negative outcomes arising from pervasive non-contingent and suboptimal outcomes in many aspects of the TBI patient’s life, lead to feelings of low personal control over the environment and contribute to lowered self-esteem and self-efficacy. This cognitive style contributes to the TBI patient’s experience of a negative emotional state. These feelings of depression and despair feed back to the cognitive beliefs, and a negative motivational state, both of which may lead to poor selection of coping strategies” (p. 118).

According to Moore and Stambrook’s (1995) model, this cycle occurs within the context of organic changes resulting from TBI, such that neurological and psychological variables interact. Low motivation and selection of ineffective coping strategies may lead to increased suboptimal outcomes, strengthening this negative cycle.

Although preliminary studies providing support for such a model yield promising results, further research is needed. Despite recognition by Moore and Stambrook (1995) in their conceptual model that the constructs of locus of control and self-efficacy interact and influence one another, existing studies have examined these constructs in isolation.



Future studies should examine the influence of both general beliefs regarding control of reinforcement (locus of control) as well as task specific self-appraisal (self-efficacy) in order to determine the degree to which they overlap as well as the manner in which they influence rehabilitation outcomes following TBI.

Secondly, existing studies examining the relationship between self-efficacy, locus of control, and rehabilitation outcomes following TBI have been conducted primarily with Canadian outpatients. It may be that differences in Canada's health care system or cultural variables influence participant's belief systems to some degree. Research utilizing American participants is needed to determine whether general cognitive beliefs and specific cognitive self-appraisal remain robust variables related to outcomes following TBI across varying cultural and health care contexts.

Although existing studies support the premise that cognitive beliefs and appraisals play an important role in determining outcome following TBI, they are somewhat limited methodologically. Specifically, existing studies have exclusively utilized single-measurement designs in order to establish relationships between cognitive variables and outcomes following TBI, limiting the extent to which researchers can determine whether cognitive variables are related over time to the dependent measure of outcome. Future research should examine the change in locus of control and self-efficacy over time as it relates to change in outcomes over time, such as is the case in a pre-test-post-test design.

Finally, research regarding both locus of control beliefs and self-efficacy beliefs has important implications for rehabilitation, pointing to the need for outcome studies investigating interventions based on promoting positive and optimistic appraisal of situations while diminishing denial, resignation, and escape. Dumont, et al. (2004)

suggest the need for future research to examine outcomes of ecological interventions targeting self-efficacy and will as a means for improving social participation. Similarly, Moore and Stambrook (1995) indicate the need for interventions focused on preventing the development of inaccurate and dysfunctional belief systems, making normative and recovery-based transitions less difficult, and promoting increased compliance and benefit from therapies by targeting cognitive moderators as a focus of rehabilitation. Including cognitive moderators as a potential rehabilitation treatment focus may be an important advance in rehabilitation, going beyond a strictly remedial, damage-based model, to a model that optimizes adjustments as it attempts to prevent the development and overgeneralization of negative attributions (1995).

#### *The Life Coach Model of Community Integration*

The Life Coach model of community re-entry represents post-acute rehabilitation for TBI which seeks to ameliorate deficits remaining after restorative therapy has derived maximum benefit through a focus on direct skills training and application (Jones, Patrick, Evans, & Wulff, 1991). There are several components characteristic of an integrated, community-based instructional model. First, skills training is most successful when it involves context-relevant instruction, such that the skills being taught have immediate utility, are taught in the physical context in which they will be used, and are adaptable or generalizable to different situations (1991). Second, an integrated treatment approach is utilized in which the professional works with the client, other clinicians, and family members in a consultative fashion to examine the client's needs in a variety of natural settings, establish context-relevant instructional materials, and to enlist others to assist the client in conducting activities (1991). Finally, behaviorally-based instruction is utilized

to establish stimulus control, or the functional relationship between an antecedent stimulus and changes in the probability that a desired response will occur following the stimulus, and to promote response precision, involving both generalization of skills to appropriate situations and discrimination of occasions when responding is not appropriate (1991). In their description of the Life Coach Model of community re-entry, Jones, et al. (1991) identify five additional factors which distinguish this model from other service delivery options:

- 1) Treatment is provided in “real word,” community settings in which the client is expected to use community living skills, such as the client’s home, workplace, school, or other community settings.
- 2) Rather than providing a variety of fragmented therapies, most treatment is provided to the client by a single Life Coach, who is a licensed or certified clinician trained as a generalist. The role of the Life Coach changes from that of management to consultation as the client acquires skills and self-confidence in order to ensure autonomy.
- 3) Whereas traditional post-acute programs focus on the acquisition of skills, the Life Coach Model focuses on the application of skills as the client performs everyday activities in the community, such that treatment focuses on addressing skill deficits in specific contexts.
- 4) Ecological variables that influence the client’s outcome are assessed and incorporated into treatment in an effort to create an “ecosystem” which promotes client progress and ensures durable outcomes (e.g., family training).

- 5) Rehabilitation is tailored to the client's individual needs as well as to his or her unique living situation.

Radical Rehab Solutions is an intensive community-based transitional living program for individuals with TBI which serves as a bridge between the brain-injured individual's discharge from hospital-based rehabilitation and their return to independent living in the community. Radical Rehab Solutions incorporates a Life Coach Model of rehabilitation with principles from social learning theory in order to increase self-awareness, establish self-efficacy, provide social support, and facilitate context-relevant application of coping skills and compensatory strategies (Radical Rehab Solutions, LLC [RRS], 2003).

Consistent with research recommendations for evaluation of ecological intervention models for improving self-efficacy (Dumont, et al., 2004) and interventions based on promoting positive appraisal of situations while diminishing denial and resignation for individuals with TBI (Moore & Stambrook, 1994), Radical Rehab Solutions seems to utilize a holistic approach to TBI rehabilitation rather than a traditional approach based purely on a medical model.

The Radical Rehab program provides for intensive social learning via four avenues: (1) intensive, one-on-one Life Skills training; (2) participation in a therapeutic community/milieu; (3) daily process-oriented cognitive re-training group; and (4) weekly group goal-setting sessions (RRS, 2003). The program incorporates the services of a one-on-one highly-trained Life Skills Trainer to maximize the client's level of personal accountability, provide immediate and consistent feedback regarding the appropriateness of demonstrated behavior, and to provide ongoing training in the use of compensatory cognitive strategies. Consistent with Bandura's (1977) assertion that performance

accomplishments, or personal mastery experiences, are the most effective means for improving self-efficacy beliefs, as well as Rotter's (1972) declaration that history of reinforcement influences expectancies, the initial role of the Life Skills Trainer is to facilitate a series of success experiences for the client through very small gains in order to establish adequate self-efficacy (RRS, 2003). Once self-efficacy is established, the client is provided with negative feedback when appropriate to increase awareness of deficits. The role of the Life Skills Trainer is based on the therapeutic relationship, which provides reinforcement for even minute gains, serves as a disincentive to unwanted behaviors, and is essential to providing the client with a sense of self-efficacy to strive to overcome the deficits associated with their injury (2003).

The second component of the Radical Rehab program, participation in a therapeutic community/milieu, refers to individuals' involvement in daily group activities, including a process-oriented cognitive retraining group, a structured day treatment program, and community outings, that utilize the influence of relationships in the group to reinforce desirable behavior and extinguish undesirable behavior (RRS, 2003). Related to Rotter's (1972) conceptualization that perception of a causal relationship between behavior and reinforcement influences expectancies, group activities provide clients with the opportunity for interpersonal learning, such that they are provided with immediate feedback from their peers regarding the appropriateness of their behavior. For instance, clients set weekly attainable goals in the presence of the therapeutic community and receive positive or negative feedback from the group when progress towards goals is reviewed each week.

The third component of the program involves participation in a daily, process-oriented cognitive re-training group that provides intensive education regarding cognitive, neurobehavioral, and psychological issues related to brain injury as well as intensive training in compensatory techniques for managing cognitive and behavioral changes following TBI (RRS, 2003). This aspect of the program appears to address Bandura's (1977) suggestion that verbal persuasion and emotional arousal are variables influencing self-efficacy. Verbal persuasion refers to the use of suggestion to convince others that they can cope with previously overwhelming stressors (1977). Related to this idea, the over-arching theme of topics addressed in the cognitive re-training group appears to be that the consequences of TBI are manageable, reflected in training of compensatory strategies as well as discussions regarding the coping process following TBI and the role of self-efficacy in the recovery process. Emotional arousal provides cues related to personal competency, such that high levels of physiological arousal (i.e., anxiety) lower self-efficacy appraisals (1977). The cognitive re-training group appears to address emotional self-regulation through topics related to managing depression after TBI, anger management strategies, managing mood changes after TBI, and managing the "fight or flight" response.

The final component of the Radical Rehab program consists of weekly goal-setting groups in which all clients and Life Skills Trainers gather so that clients may set attainable weekly goals and receive positive or negative feedback, depending on their success at meeting goals established the previous week. The practice of setting weekly goals is based on the observation that, after the initial 6-9 months post-injury, an individual's rate of recovery tends to slow down and appear to plateau (RRS, 2003).

Perceiving that their rehabilitation efforts are of no avail, clients may be at risk to give up at this point. Setting weekly attainable goals provides the TBI survivor with the important feedback that they are continuing to recover-thereby increasing their self-efficacy beliefs in their ability to do what is necessary to cope with their injury (2003). The weekly goal session serves to increase autonomy and allow clients to have an active role in determining the course of their rehabilitation, in that clients are working on their own personal goals, rather than those established by a therapist. Furthermore, since clients are actively engaged in providing feedback to peers regarding weekly progress, weekly goal setting-groups may also serve to increase self-efficacy through vicarious experience. According to Bandura (1977), seeing others perform threatening activities without adverse consequences can generate expectations in observers that they too will improve if they intensify and persist in their efforts. In other words, observing their co-clients attain weekly goals may serve as another source of increasing individuals' beliefs that they can successfully cope with TBI.

Radical Rehab Solutions utilizes a holistic approach to TBI rehabilitation which seems to satisfy recommendations made by researchers for new approaches to TBI rehabilitation incorporating ecological interventions for the purpose of maximizing benefit from therapies through preventing the development of inaccurate and dysfunctional belief systems (Dumont, et. al., 2004; Moore & Stambrook, 1995). Furthermore, the program is rooted in social learning theory, incorporating Bandura's (1977) recommendations for increasing self-efficacy beliefs into treatment (such that interventions address performance accomplishments, vicarious experience, verbal persuasion, and emotional arousal) as well as Rotter's (1972) formulation for developing

generalized control expectancies (such that interventions are tailored to establish a positive history of reinforcement and foster the perception of a causal relationship between behavior and outcomes).

### *Overview of the Current Study*

The purpose of the current study is to provide further support for a model that views cognitive beliefs as predictors of outcome following TBI by evaluating the role of self-efficacy and internal locus of control beliefs in predicting community integration for participants of a holistic, intensive TBI rehabilitation program. Preliminary research provides evidence that robust relationships exist between both self-efficacy and locus of control beliefs and outcomes following TBI. However, existing studies have exclusively utilized single-measurement designs, providing no information regarding the manner in which change in self-efficacy and locus of control beliefs relate to change in outcome variables over time. Since there is general consensus that community integration represents a primary goal of TBI rehabilitation, the current study aims to examine the relationship between change in self-efficacy and locus of control beliefs as it relates to change in community integration at a 90-day follow-up. It is hypothesized that change in self-efficacy and locus of control beliefs will be more predictive of change in participants' level of community integration than their injury severity.



## CHAPTER THREE

## Method

*Participants*

Participants were recruited from an intensive life skills training program, Radical Rehab Solutions (RRS) located in southern West Virginia and eastern Kentucky.

Rehabilitation services provided by the program include intensive life skills training, participation in a therapeutic community/milieu, cognitive re-training group, weekly goal-setting groups, psycho-education regarding TBI, training in compensatory strategies to manage cognitive and emotional symptoms associated with TBI, as well as occupational therapy, physical therapy, and speech therapy tailored to the individual needs of each client. Eligibility criteria for the study included: age of at least 18 years, at least 1 year since the time of injury, moderate TBI or worse as determined by coma duration of one hour or longer, as well as the ability to understand the nature of the study and the process of consent. Initially, additional participants were recruited from TBI support groups throughout the state of West Virginia. However, these individuals were excluded from the final sample due to incomplete historical information (e.g., time since injury, length of time unconscious) as well as failure to provide all required measures (e.g., CIQ completed by significant other).

A total of 24 participants were included in the final study sample. The final sample size is consistent with existing standards for TBI research, which recommend a sample size of at least 20 (Goranson, et al., 2003). All participants were Caucasian, English-speaking individuals residing in southern West Virginia and eastern Kentucky. Nineteen males and 5 females participated in the study, which is consistent with the incidence of

TBI in the general population as males are more than twice as likely as females to sustain TBI (NIH, 1998). Ages ranged from 22 to 57 ( $M= 34.38$ ,  $SD= 10.29$ ). The education level of participants ranged from 8 years to 15 years ( $M= 12.04$ ,  $SD= 1.49$ ). The number of months since injury ranged from 12 to 444 ( $M=134.42$ ,  $SD= 122.86$ ). The length of time unconscious was used as an indicator of injury severity, as variable documentation in participants' medical records precluded the use of other indicators of injury severity. The length of time unconscious ranged from 1 hour to 195 days ( $M= 56.05$ ,  $SD= 48.57$ ). Table 1 provides a summary of demographic and historical information for study participants.

Table 1:  
Demographic & Historical Variables

Variable	N	Minimum	Maximum	Mean	Std. Deviation
Age (Years)	24	22	57	34.3750	10.29484
Education (Years)	24	8	15	12.0417	1.48848
Time Since Injury (Months)	24	12	444	134.4167	122.86150
Injury Severity (Days)	24	.04	195.00	56.0450	48.57625
Gender	Male= 19 (79.2%) Female= 5 (20.8%)				

### *Measures*

The Multidimensional Health Locus of Control (Form C) (MHLC) was administered as a measure of locus of control beliefs (See Appendix A). The MHLC is an 18-item, condition-specific, Likert scale, self-report measure that can be adapted for use with any

medical or health-related condition, with responses ranging from 1 (strongly disagree) to 6 (strongly agree.) Responses are grouped into four subscales: internal, chance, doctors, and powerful others, such that higher scores reflect stronger agreement with control of reinforcement being governed by that domain. The scale is one of the most frequently used measures to assess control of reinforcement beliefs of individuals with chronic illness. Generally, the results have been moderately reliable, with Cronbach alphas in the .60 to .75 range and test-retest stability coefficients ranging from .60 to .70 (Wallston, 1998). Form C subscales have been shown to be moderately stable over time and to possess considerable concurrent and construct validity (Wallston, Stein, & Smith, 1994).

Subscales from the Chronic Disease Self-Efficacy Scales (Obtain Help from Community, Family, Friends Scale; Do Chores Scale; & Social/Recreational Activities Scale) were administered (See Appendix B) as measures of self-efficacy relevant to the home integration and social integration domains assessed by the Community Integration Questionnaire (See Appendix C). In addition, four items regarding individuals' belief in their ability to engage in vocational activities were written specifically for the current study to correspond with the productivity domain assessed by the Community Integration Questionnaire. The three subscales of the Chronic Disease Self-Efficacy Scales relevant to community integration (Obtain Help from Community, Family, Friends Scale; Do Chores Scale; & Social/Recreational Activities Scale) constitute 9 Likert scale items ranging from 1 (not at all confident) to 10 (totally confident), such that higher scores reflect higher levels of self-efficacy. Evidence for the scales' validity and reliability has been established with a variety of groups suffering from chronic illness (Lorig, et al., 1996). Test-retest reliability coefficients have ranged from .84 to .86. Multi-trait scaling

studies pertaining to behaviors and the corresponding self-efficacy for performing those behaviors confirmed that the self-efficacy and the behavior scales were measuring different constructs. Thus, the scales measuring self-efficacy to perform behaviors are sufficiently independent of the actual behaviors that they can be interpreted as distinct scales (1996).

The Community Integration Questionnaire (CIQ) was administered as a measure of community participation. It is a 15-item self report inventory that considers community integration to be made up of three areas of community functioning: control over one's home environment, integration into a social support network, and integration into productive and meaningful daytime activities. In a study of 312 subjects, a three-factor structure was confirmed by a factor analysis and is represented in the instrument's three subscales: home integration, social integration, and productivity (Sander et al., 1999). The items on the CIQ produce a total score that reflects these three areas of functioning. The higher the score, the more integrated the individual. Willer, Linn, and Allen (1993) found that the interrater reliability of the CIQ is in the acceptable range. However, Sander et al. (1997) suggested that individuals with TBI tend to report higher values than their significant others on the Home Integration scale of the CIQ. Evidence for the CIQ's validity with the TBI population is well established by the test developers and by other researchers in subsequent investigations (Sander, et al., 1999). Test-retest reliability coefficients have ranged from .83 to .97, and concurrent and discriminant validity have been established (Willer, et al., 1994).

*Procedures*

RRS program administrative staff initiated participant recruitment by contacting current program clients meeting eligibility criteria in order to determine their interest in the study. Interested individuals met with the study's Co-Investigator to discuss the purpose of the study as well as key elements of the consent process. Potential participants were presented with the study consent form and a verbal description of the consent process. Screening for competence was obtained by asking potential participants to paraphrase the purpose of the study and key elements of the consent process. Two individuals were excluded from the study as a result of their inability to clearly communicate an understanding of the study and informed consent. Written and verbal consent was also obtained from legal guardians of participants in cases where such an individual had been appointed.

Upon obtaining informed consent, a review of participants' medical records was completed in order to obtain demographic information related to age, sex, education level, time since injury, as well as length of time unconscious. Participants met with the study's Co-Investigator to complete the Community Integration Questionnaire (CIQ), Multidimensional Health Locus of Control (Form C) (MHLC), and the Chronic Disease Self-Efficacy Scales (CDSES) at baseline as well as at 90-day follow-up. All measures were read to participants in order to ensure material comprehension. In order to substantiate the reported level of community integration of study participants, Life Skills Trainers assigned to work with participants in the RRS program also completed the CIQ regarding participants' levels of community integration at baseline and at a 90-day follow-up.

### *Design and Hypotheses*

The goal of the current study is to test a model which views cognitive beliefs as predictors of outcome following TBI independent of injury severity. A pre-test post-test design was utilized to examine the association of internal locus of control and self-efficacy beliefs with community integration following TBI over time. Demographic information regarding participants' age, gender, educational level, time since injury, and injury severity (length of time unconscious) was obtained via retrospective chart review. In order to establish baseline levels of locus of control beliefs, self-efficacy beliefs, and community integration, participants completed the Multidimensional Health Locus of Control scale (Form C), the Chronic Disease Self-Efficacy scales, as well as the Community Integration Questionnaire. Life Skills Trainers of participants completed the Community Integration Questionnaire regarding participants' levels of community integration in order to increase accuracy and substantiate the reported level of community integration for study participants. The same procedure was repeated at 90-day follow up.

In order to test the following hypothesis, data regarding injury severity, change in self-efficacy from baseline to follow-up, and change in internal locus of control beliefs from baseline to follow-up were entered into a multiple regression analysis in order to determine influence upon change in community integration from baseline to follow-up: Change in self-efficacy and internal locus of control beliefs will be more predictive of change in community integration from baseline to follow-up than injury severity. The variables examined were as follows:

*D.V.= Change in community integration from pre-test to post-test  
(difference scores on CIQ)*

*I.V.= Injury severity (loss of consciousness)*

*Change in internal locus of control from pre-test to post-test  
(difference scores on MHLC Internal scale)*

*Change in self-efficacy  
(difference scores on CDESES)*

#### *Data Analysis*

SPSS version 11.5 was used for all statistical calculations. Bivariate Pearson's product-moment correlations were used to examine relationships between each of the study's continuous demographic and historical variables (age, education, time since injury, injury severity), dependent variables (pre-test post-test scores on the CIQ), and independent variables (pre-test post-test scores on the MHLC and CDESES). Independent sample *t*-tests were applied to explore group differences between male and female participants and pre-test, post-test scores on each of the study's measures. Independent samples *t*-tests were also used to examine differences between participant and Life Skills Trainer responses on the CIQ. Paired samples *t*-tests were conducted to examine changes in each of the study's continuous variables from pre-test to post-test. Finally, standard multiple regression analyses were performed in order to test the hypothesis that change in self-efficacy and internal locus of control beliefs would be more predictive of change in community integration than injury severity. A top-down approach was utilized in which all of the independent variables were put into a standard multiple regression first using the "enter" method in SPSS. Each of the independent variables was then entered into a simple regression in order to further evaluate their ability to predict change in community integration.

## CHAPTER FOUR

### Results

#### *Participant Variables*

Exploratory analyses were conducted evaluating significant relationships among demographic and historical variables and the study's independent and dependent variables. Bivariate Pearson's product-moment correlations were used to examine relationships between each of the continuous demographic and historical variables (age, education, time since injury, injury severity) and pre-test, post-test, and difference scores obtained on the CIQ, MHLC, and CDSSES. Independent sample *t*-tests were applied to explore group differences between male and female participants and scores on each of these measures.

An examination of the correlations between age and scores obtained on the CIQ, MHLC, and CDSSES revealed one significant relationship. Age and post-test vocational self-efficacy scores were negatively correlated ( $r = -.450, p < 0.05$ ), indicating that older participants reported lower levels of vocational self-efficacy at post-test.

Analysis of the relationships between education level and scores on each of the measures revealed a significant positive correlation between education level and pre-test social integration on the CIQ ( $r = .451, p < 0.05$ ). The higher the participant's education level, the higher their level of reported social integration at pre-test.

Exploration of relationships between the amount of time since participants were injured and scores on the CIQ, MHLC, and CDSSES revealed no significant correlations.

Examination of the correlations between injury severity (length of time unconscious) and scores on all administered measures revealed a significant negative correlation



between injury severity and pre-test scores on the Chores subscale of the CDSES ( $r = -.470, p < 0.05$ ), indicating that the greater the individual's injury severity, the lower their reported self-efficacy for completing chores at pre-test. However, injury severity and the Chores subscale difference scores on the CDSES were positively correlated ( $r = .511, p < 0.05$ ), revealing that the greater the participant's injury severity, the greater amount of change they reported from pre-test to post-test in their self-efficacy for completing chores (DIFFCHRS  $M = .0296, SD = 2.20$ ).

Independent samples  $t$ -tests showed no significant differences between males and females in terms of age ( $t(22) = 2.02, p > .05$ ), education level ( $t(22) = .401, p > .05$ ), time since injury ( $t(22) = 1.19, p > .05$ ), or injury severity ( $t(22) = -4.14, p > .05$ ). An examination of the differences between male and female participants on CIQ, MHLC, and CDSES scores revealed a significant difference between male and female difference scores on the Internal Locus of Control subscale of the MHLC ( $t(22) = 2.516, p < .05, d = 1.26$ ). The mean difference score for males on the Internal Locus of Control subscale ( $M = -0.6842, SD = 4.84$ ) was significantly lower than the mean score for females ( $M = -6.40, SD = 2.61$ ). In other words, females reported a significantly greater change, or decrease, in internal locus of control than males from pre-test to post-test. A significant difference between males and females was also found on pre-test scores of the Chores subscale of the CDSES ( $t(22) = -3.143, p < .05, d = -1.58$ ). The mean pre-test Chores subscale score for males ( $M = 6.99, SD = 2.71$ ) was significantly lower than the mean score for females ( $M = 9.33, SD = 0.92$ ), indicating that males reported lower self-efficacy for completing chores at pre-test than females.

*Comparison of Participant and Life Skills Trainer Responses on the CIQ*

In order to increase accuracy and substantiate the reported level of community integration for study participants, RRS staff completed the CIQ regarding participants' levels of community integration. Independent samples t-tests were conducted to examine differences between participant and Life Skills Trainer responses on the CIQ. No significant differences were observed between participants' and Life Skills Trainers' reports in terms of pre-test total CIQ scores ( $t(46) = -1.15, p > .05$ ), post-test total CIQ scores ( $t(46) = -1.14, p > .05$ ), pre-test Home Integration scale scores ( $t(46) = -0.66, p > .05$ ), post-test Home Integration scale scores ( $t(46) = .030, p > .05$ ), pre-test Social Integration scale scores ( $t(46) = .000, p > .05$ ), post-test Social Integration scale scores ( $t(46) = -0.45, p > .05$ ), or pre-test Productivity scale scores ( $t(46) = -1.76, p > .05$ ). However, there was a significant difference between participants' and Life Skills Trainers' responses at post-test on the Productivity scale of the CIQ ( $t(46) = -2.41, p < .05, d = -0.695$ ). At post-test, participants rated their level of involvement in productive activities significantly lower ( $M = 3.50, SD = 1.77$ ) than did their Life Skills Trainers ( $M = 4.71, SD = 1.71$ ). In general, participants' ratings of their levels of community integration tended to be lower than the ratings of their therapeutic staff. Table 2 provides a summary of participant and Life Skills Trainer ratings on the CIQ.

Table 2:

Comparison of Participant and Life Skills Trainer Responses on the CIQ

CIQ Scale	Respondent	N	Mean	SD	t-score	Sig.
<b>Pre-Test CIQ Total Score</b>	Participant	24	12.99	4.16	-1.15	.258
	Life Skills Trainer	24	14.28	3.64		
<b>Post-Test CIQ Total Score</b>	Participant	24	14.30	4.26	-1.14	.261
	Life Skills Trainer	24	15.71	4.31		
<b>Pre-Test</b>	Participant	24	4.53	2.49	-.661	.512

<b>Home Integration</b>	Life Skills Trainer	24	4.95	1.82		
<b>Post-Test</b>	Participant	24	4.79	2.17	.030	.976
<b>Home Integration</b>	Life Skills Trainer	24	4.77	2.14		
<b>Pre-Test</b>	Participant	24	5.83	1.76	.000	1.0
<b>Social Integration</b>	Life Skills Trainer	24	5.83	1.79		
<b>Post-Test</b>	Participant	24	5.96	2.01	-.452	.653
<b>Social Integration</b>	Life Skills Trainer	24	6.21	1.82		
<b>Pre-Test</b>	Participant	24	2.63	1.47	-1.76	.084
<b>Productivity</b>	Life Skills Trainer	24	3.50	1.93		
<b>Post-Test</b>	Participant	24	3.50	1.77	-2.41	.020
<b>Productivity</b>	Life Skills Trainer	24	4.71	1.71		

*Comparison of Variables from Baseline to Follow-up*

*Total CIQ*

Paired samples *t*-tests were conducted to examine changes in study variables from pre-test to post-test. The results of a two-tailed paired samples *t*-test revealed a significant increase in total CIQ scores ( $M= 1.31$ ,  $SD= 2.71$ ) from pre-test to post-test ( $t(23)= 2.38$ ,  $p < .05$ ). Figure 1 illustrates the mean change in total CIQ scores from baseline to follow-up.

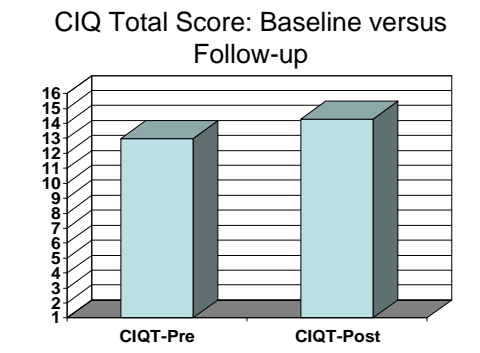


Figure 1: CIQ Total Score: Baseline to Follow-up

*CIQ Home Integration*

Participants had a mean value indicative of increased overall home integration on the CIQ from pre-test to post-test ( $M= .31$ ,  $SD= 1.74$ ). However, paired samples *t*-tests comparing baseline to follow-up home integration scale scores did not reach

statistical significance ( $t(23) = .88, p > .05$ ). Figure 2 illustrates the mean change in Home Integration scale scores on the CIQ from baseline to follow-up.

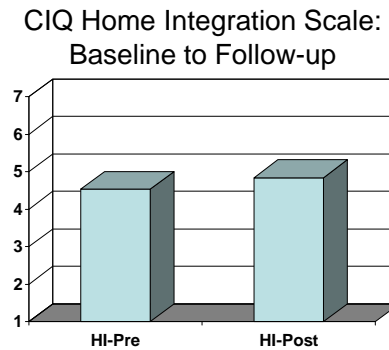


Figure 2: CIQ Home Integration Scale: Baseline to Follow-up

### *CIQ Social Integration*

Participant's mean change score on the Social Integration scale of the CIQ indicates an overall reported increase in reported social integration from pre-test to post-test ( $M = .13, SD = 1.33$ ). However, results of paired samples  $t$ -test revealed that the increase in social integration from baseline to follow-up was not statistically significant ( $t(23) = .461, p > .05$ ). Figure 3 summarizes the mean increase in social integration from pre-test to post-test.

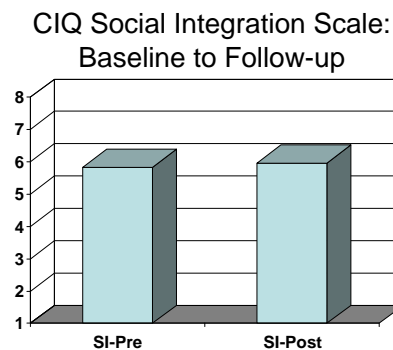


Figure 3: CIQ Social Integration Scale: Baseline to Follow-up

*CIQ Productivity*

Participants reported an overall increase in involvement in meaningful activities on the CIQ Productivity scale from pre-test to post-test ( $M = .88$ ,  $SD = 1.42$ ). Results of a paired samples  $t$ -test revealed that this increase was statistically significant ( $t(23) = 3.01$ ,  $p < .05$ ). Figure 4 presents the mean increase in the CIQ Productivity scale from baseline to follow-up.

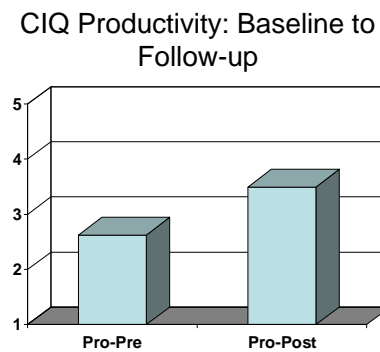


Figure 4: CIQ Productivity: Baseline to Follow-up

*MHLC Internal Scale*

Participants reported an overall decrease in internal locus of control on the MHCL Internal scale from pre-test to post-test ( $M = -1.88$ ,  $SD = 5.01$ ). However the change in internal locus of control from baseline to follow-up did not reach statistical significance ( $t(23) = -1.83$ ,  $p > .05$ ). Figure 5 illustrates the mean change in internal locus of control from pre-test to post-test.

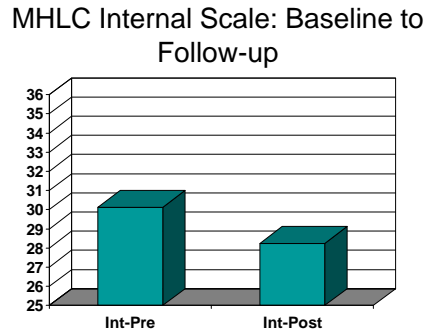


Figure 5: MHLC Internal Scale: Baseline to Follow-up

#### *MHLC Chance Scale*

Participants reported an overall decrease in chance locus of control beliefs on the MHLC Chance scale from pre-test to post-test ( $M = -1.33$ ,  $SD = 5.81$ ). Results of a paired samples  $t$ -test indicate that this decrease was not statistically significant ( $t(23) = -1.13$ ,  $p > .05$ ). Figure 6 summarizes the mean change in chance locus of control beliefs from baseline to follow-up.

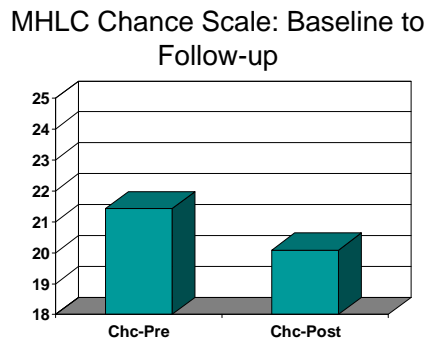


Figure 6: MHLC Chance Scale: Baseline to Follow-up

#### *MHLC Doctors Scale*

Participants reported an overall decrease in their belief that doctors are responsible for changes in their health from baseline to follow-up on the Doctors scale of the MHLC ( $M = -2.04$ ,  $SD = 5.28$ ). Results of a paired samples  $t$ -test reveal that there was

a significant decrease in the mean Doctors scale scores of the MHLC from pre-test to post-test ( $t(23) = -2.66, p < .05$ ). Figure 7 displays the mean change in MHLC Doctors scale from baseline to follow-up.

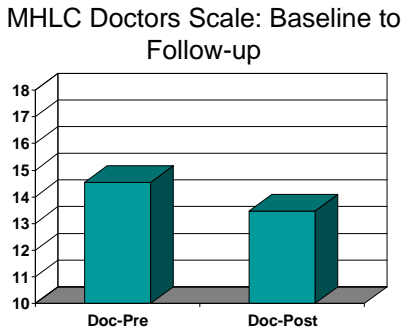


Figure 7: MHLC Doctors Scale: Baseline to Follow-up

#### *MHLC Powerful Others*

An overall decrease was seen in participants' belief that powerful others are responsible for changes in their health from pre-test to post-test as reported on the Powerful Others scale of the MHLC ( $M = -1.5, SD = 3.97$ ). However, results of a paired samples  $t$ -test indicate that this decrease did not approach statistical significance ( $t(23) = -1.29, p > .05$ ). Figure 8 illustrates the mean change in powerful others locus of control from baseline to follow-up.

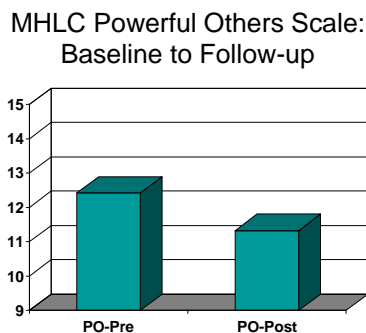


Figure 8: MHLC Powerful Others scale: Baseline to Follow-up

*CDSES Total Score*

Participants reported a marginal increase in overall self-efficacy beliefs on the CDSES from pre-test to post-test ( $M=.05$ ,  $SD= 1.60$ ). This increase was not found to be statistically significant ( $t(23)= .145$ ,  $p > .05$ ). Figure 9 displays the mean increase in overall self-efficacy beliefs from baseline to follow-up.

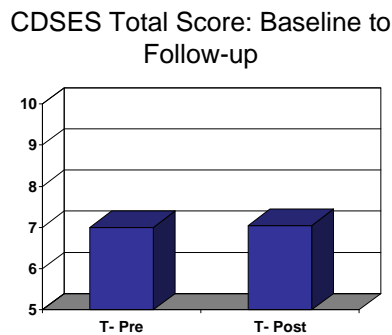


Figure 9: CDSES Total Score: Baseline to Follow-up

*CDSES Chores Scale*

Participants reported a mild overall increase in their self-efficacy for completing chores from pre-test to post-test as measured by the CDSES Chores scale. Results of a paired samples  $t$ -test reveal that this increase was not statistically significant ( $t(23)= .059$ ,  $p > .05$ ). Figure 10 represents the mean change in self-efficacy for completing chores from baseline to follow-up.

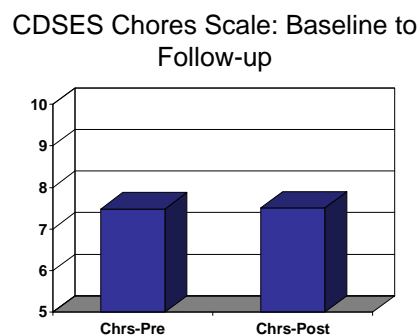


Figure 10: CDSES Chores Scale Baseline to Follow-up



### *CDSES Social Scale*

Participants reported an overall increase in social self-efficacy from pre-test to post-test as measured by the Chores scale of the CDSES ( $M = .13$ ,  $SD = 2.20$ ). This increase was not found to be statistically significant ( $t(23) = .278$ ,  $p > .05$ ). Figure 11 illustrates the mean change in social self-efficacy from baseline to follow-up.

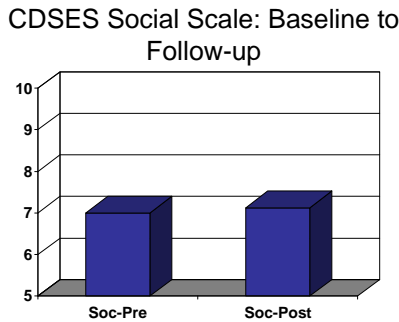


Figure 11: CDSES Social Scale: Baseline to Follow-up

### *Vocational Self-Efficacy*

A mild increase in overall vocational self-efficacy was reported from pre-test to post-test ( $M = .04$ ,  $SD = 2.18$ ), but was not found to be statistically significant by a paired samples  $t$ -test ( $t(23) = .309$ ,  $p > .05$ ). Figure 12 summarizes the mean change in vocational self-efficacy from baseline to follow-up.

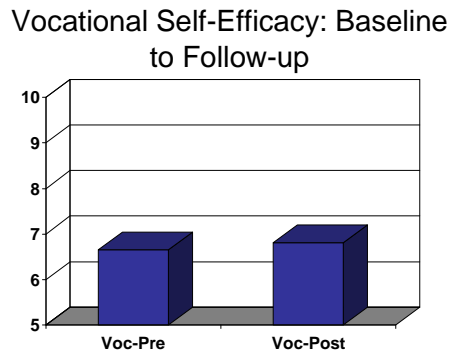


Figure 12: Vocational Self-Efficacy from Baseline to Follow-up

### *Overall Community Integration*

Exploratory standard multiple regression analyses were conducted in order to examine the relationships between overall community integration and the independent variables (injury severity, internal locus of control, & overall self-efficacy) at pre-test and post-test. At baseline, injury severity, pre-test internal locus of control, and pre-test overall self-efficacy accounted for 26% of the variance in pre-test community integration. However, this model was not found to be statistically significant  $F(3, 20) = 2.39, p > .05$ . When entered into simple regression analyses as the sole predictor of pre-test community integration, injury severity accounted for 0% of the variance ( $R^2 = .004$ ) and failed to produce a significant model,  $F(1, 22) = .096, p > .05$ . Similarly, pre-test internal locus of control as the sole predictor also failed to produce a significant model,  $F(1, 22) = 2.41, p > .05$ , accounting for approximately 10% of the variance in pre-test community integration ( $R^2 = .099$ ). However, pre-test overall self-efficacy was found to reliably predict pre-test community integration,  $F(1, 22) = 6.9, p < .05$ , accounting for 24% of the variance ( $R^2 = .239$ ).

At follow-up, injury severity, post-test internal locus of control, and post-test overall self-efficacy were found to reliably predict post-test community integration,  $F(3, 20) = 3.12, p = .05$ , accounting for 31% of the variance ( $R^2 = .318$ ). In terms of individual relationships between the independent variables and post-test community integration, injury severity ( $t = -.059, p > .05$ ) and post-test internal locus of control ( $t = -.334, p > .05$ ) were not found to be significant predictors. However, post-test overall self-efficacy was found to reliably predict post-test community integration ( $t = 2.97, p < .05$ ). When entered into simple regression analyses, injury severity accounted for 0 % of the

variance in post-test community integration ( $R\text{-square} = .002$ ),  $F(1, 22) = .035$ ,  $p > .05$ ; post-test internal locus of control accounted for 2% of the variance ( $R\text{-square} = .016$ ),  $F(1, 22) = .368$ ,  $p > .05$ ; and post-test overall self-efficacy accounted for 31% of the variance ( $R\text{-square} = .314$ ),  $F(1, 22) = 10.07$ ,  $p < .05$ .

A standard multiple regression analysis was performed in which the dependent variable was overall change in community integration (CIQ total difference score) and the independent variables were injury severity (loss of consciousness), change in internal locus of control (Internal scale of MHLC difference score), and change in overall self-efficacy (CDESES total difference score) in order to test the hypothesis that change in self-efficacy and locus of control beliefs will be more predictive of change in participants' level of community integration than their injury severity. Regression analysis revealed that the model did not reliably predict change in overall community integration,  $F(3, 20) = .869$ ,  $p > .05$ .  $R\text{-square}$  for the model was .115, revealing that injury severity, change in internal locus of control, and change in overall self-efficacy accounted for 11% of the variance in change in overall community integration. No significant individual relationships were found between injury severity ( $t = -0.22$ ,  $p > .05$ ), change in internal locus of control ( $t = -0.301$ ,  $p > .05$ ), change in overall self-efficacy ( $t = 1.22$ ,  $p > .05$ ) and change in overall community integration. Table 3 displays the unstandardized regression coefficients, intercept, and standardized regression coefficients for each variable.

**Table 3:**  
**Change in Overall Community Integration: Regression Coefficients**

<b>Coefficients(a)</b>						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.671	.881		1.896	.073
	INSEVRTY	-.012	.013	-.220	-.920	.369
	DFFINTER	-.162	.124	-.301	-1.305	.207
	DFFSLFEF	.468	.382	.278	1.226	.235

a. Dependent Variable: DIFFCIQ

Each of the independent variables was entered into a simple regression in order to further evaluate their ability to predict change in overall community integration. When injury severity was entered as the predictor, R-square for the model was .001,  $F(1,22) = .033$ ,  $p > .05$ . When change in internal locus of control was the sole predictor, R-square was .037,  $F(1,22) = .841$ ,  $p > .05$ . Change in overall self-efficacy entered as a predictor yielded an R-squared of .031,  $F(1,22) = .711$ ,  $p > .05$ . Although none of the independent variables reliably predicted change in overall community integration, partial support for the hypothesis was found as change in internal locus of control and change in overall self-efficacy were slightly more predictive of change in community integration than injury severity.

### *Home Integration*

Exploratory standard multiple regression analyses were conducted in order to evaluate the relationships between home integration and the independent variables (injury severity, internal locus of control, and chores self-efficacy) at pre-test and post-test. At baseline, injury severity, pre-test internal locus of control, and pre-test chores self-efficacy failed to reliably predict pre-test home integration,  $F(3, 20) = .129$ ,  $p > .05$ ,

accounting for only 2% of the variance ( $R\text{-square} = .019$ ). No significant individual relationships were found between pre-test home integration scores and injury severity ( $t = .037, p > .05$ ), pre-test internal locus of control ( $t = .094, p > .05$ ), or pre-test chores self-efficacy ( $t = .491, p > .05$ ). At follow-up, injury severity, post-test internal locus of control, and post-test chores self-efficacy also failed to reliably predict post-test home integration,  $F(3, 20) = 1.19, p > .05$ , accounting for 15% of the variance ( $R\text{-square} = .152$ ). No significant individual relationships were found between post-test home integration scores and injury severity ( $t = .566, p > .05$ ), post-test internal locus of control ( $t = -.366, p > .05$ ), or post-test chores self-efficacy ( $t = 1.83, p > .05$ ).

A standard multiple regression analysis was performed in which change in home integration from pre-test to post-test (CIQ Home Integration scale difference score) was the dependent variable and injury severity, change in internal locus of control, and change in self-efficacy for completing chores (CDSES Chores scale difference score) were the independent variables. Regression analysis revealed that the model failed to significantly predict change in home integration  $F(3, 20) = 1.52, p > .05$ . The model accounted for 18% of the variance in change in home integration ( $R\text{-square} = .186$ ).

In terms of individual relationships between the independent variables and change in home integration, a significant correlation was found between change in internal locus of control and change in home integration ( $r = -.43, p < .05$ ), indicating that the greater the decrease in internal locus of control from pre-test to post-test, the greater the change in home integration. Nevertheless, change in internal locus of control was not found to reliably predict change in home integration ( $t = -1.91, p > .05$ ). Injury severity ( $t = .18, p > .05$ ) and change in self-efficacy for completing chores ( $t = .008, p > .05$ ) also

failed to significantly predict change in home integration. Table 4 summarizes the unstandardized regression coefficients, intercept, and standardized regression coefficients for each variable.

**Table 4:**  
**Change in Home Integration: Regression Coefficients**

Coefficients(a)						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.048	.581		-.082	.935
	INSEVRTY	.002	.009	.046	.184	.856
	DFFINTER	-.143	.075	-.413	-1.918	.069
	DIFFCHRS	.001	.186	.002	.008	.994

a. Dependent Variable: DIFFHI

When entered into a simple regression, injury severity accounted for 3% of the variance in change in home integration ( $R\text{-square} = .034$ ) and was not found to be a reliable predictor,  $F(1, 22) = .786, p > .05$ . Similarly, change in self-efficacy for completing chores failed to significantly predict change in home integration  $F(1, 22) = .097, p > .05$ , accounting for 0% of the variance ( $R\text{-square} = .004$ ). However, change in internal locus of control was found to reliably predict change in home integration when entered into a regression as the sole predictor,  $F(1, 22) = 4.95, p < .05$ , accounting for 18% of the variance ( $R\text{-square} = .184$ ). Interestingly, change in internal locus of control was not predictive of change in home integration in the direction that was hypothesized. In other words, a decrease in internal locus of control from pre-test to post-test predicted an increase in home integration from pre-test to post-test ( $t = -2.22, p < .05$ ). Table 5 summarizes the unstandardized and standardized coefficients.

**Table 5:**  
**Change in Internal Locus of Control as Sole Predictor of Change in Home Integration:**  
**Regression Coefficients**

Coefficients(a)						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.034	.351		.097	.924
	DFFINTER	-.149	.067	-.428	-2.224	.037

a. Dependent Variable: DIFFHI

Post-hoc simple regression analyses were performed in which change in powerful others locus of control beliefs (MHLC, Powerful Others scale difference score), change in doctors locus of control beliefs (MHLC, Doctors scale difference score), and change in chance locus of control beliefs (MHLC, Chance scale difference score) were entered as individual predictors of change in home integration in order to provide additional information regarding the unexpected relationship found between change in internal locus of control and change in home integration. In general, powerful others locus of control beliefs tended to decrease from pre-test to post-test ( $M = -1.5$ ,  $SD = 3.97$ ). Change in powerful others locus of control was not a significant predictor of change in home integration,  $F(1, 22) = .049$ ,  $p > .05$ , accounting for 0% of the variance (R-square = .002). Doctors locus of control beliefs also decreased from pre-test to post-test ( $M = -2.04$ ,  $SD = 5.28$ ). Change in doctors locus of control beliefs was not found to be a significant predictor of change in home integration,  $F(1, 22) = 1.3$ ,  $p > .05$ , accounting for 5% of the variance (R-square = .055). Similarly, chance locus of control beliefs tended to decrease from pre-test to post-test ( $M = -1.33$ ,  $SD = 5.81$ ). Change in chance locus of control beliefs accounted for 4% of the variance in change in home integration (R-square = .038), and was not found to be a significant model for predicting change in home integration,  $F(1, 22) = .859$ ,  $p > .05$ . In other words, increases in powerful others, doctors, or chance

locus of control beliefs were not found to account for the negative relationship found between change in internal locus of control beliefs and change in home integration.

### *Social Integration*

Exploratory multiple regression analyses were performed in order to examine the relationships between social integration and the independent variables (injury severity, internal locus of control, and social self-efficacy) at pre-test and post-test. At baseline, injury severity, pre-test internal locus of control, and pre-test social self-efficacy were found to reliably predict pre-test social integration,  $F(3, 20) = 5.42, p < .05$ , accounting for 45% of the variance (R-square= .449). Injury severity was not found to be a significant predictor of pre-test social integration ( $t = -.325, p > .05$ ). However, pre-test internal locus of control ( $t = 2.05, p = .05$ ) and pre-test social self-efficacy ( $t = 2.97, p < .05$ ) were found to be significant predictors. When entered into simple regression analyses as the sole predictors of pre-test social integration, injury severity accounted for 0% of the variance (R-square= .007),  $F(1, 22) = .164, p > .05$ ; pre-test internal locus of control accounted for 20% of the variance (R-square= .201),  $F(1, 22) = 5.54, p < .05$ ; and pre-test social self-efficacy accounted for 32% of the variance (R-square= .329),  $F(1, 22) = 10.77, p < .05$ .

At follow-up, injury severity, post-test internal locus of control, and post-test social self-efficacy accounted for 46% of the variance in post-test social integration (R-square= .467), revealing a statistically significant model,  $F(3, 20) = 5.83, p < .05$ . In terms of individual relationships between the independent variables and post-test social integration, injury severity ( $t = -.780, p > .05$ ) and post-test internal locus of control ( $t = -.005, p > .05$ ) were not found to be significant predictors. However, post-test social self-



efficacy ( $t = 3.97, p < .05$ ) was found to reliably predict post-test social integration. When entered into simple regression analyses as the sole predictors of post-test social integration, injury severity accounted for approximately 1% of the variance (R-square = .008),  $F(1, 22) = .18, p > .05$ ; post-test internal locus of control accounted for 4% of the variance (R-square = .038),  $F(1, 22) = .88, p > .05$ ; and post-test social self-efficacy accounted for 45% of the variance (R-square = .450),  $F(1, 22) = 18.04, p < .05$ .

Results of a standard multiple regression analysis revealed that injury severity, change in internal locus of control, and change in social self-efficacy accounted for 27% of the variance in change in social integration from pre-test to post-test (R-square = .279). However, the overall model was not found to be significantly predictive of change in social integration,  $F(3, 20) = 2.58, p > .05$ . Injury severity ( $t = -1.75, p > .05$ ), change in internal locus of control ( $t = -1.43, p > .05$ ), and change in social self-efficacy ( $t = 1.63, p > .05$ ) were not significant individual predictors of change in social integration. Table 6 displays the unstandardized regression coefficients, intercept, and standardized regression coefficients for each variable. No significant individual relationships with change in social integration were found for any of the independent variables. A top down approach, in which injury severity,  $F(1, 22) = 1.47, p > .05$ ; change in internal locus of control,  $F(1, 22) = 1.39, p > .05$ ; and change in social self-efficacy,  $F(1, 22) = 3.56, p > .05$ , were entered as individual predictors of change in social integration failed to produce any significant models.

**Table 6:**  
**Change in Social Integration: Regression Coefficients**

<b>Coefficients(a)</b>						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.498	.382		1.305	.207
	INSEVRTY	-.010	.006	-.355	-1.758	.094
	DFFINTER	-.078	.055	-.296	-1.433	.167
	DIFFSOC	.191	.117	.316	1.625	.120

a. Dependent Variable: DIFFSI

### *Productivity*

Exploratory standard multiple regression analyses were conducted in order to evaluate the relationships between productivity on the CIQ and the independent variables (injury severity, internal locus of control, and vocational self-efficacy) at pre-test and post-test. At baseline, injury severity, pre-test internal locus of control, and pre-test vocational self-efficacy accounted for 23% of the variance in pre-test productivity on the CIQ ( $R\text{-square} = .231$ ). However, this was not found to be a statistically significant model,  $F(3, 20) = 2.01, p > .05$ . There were no significant individual relationships found between pre-test productivity and injury severity ( $t = .462, p > .05$ ), pre-test internal locus of control ( $t = .134, p > .05$ ), or pre-test vocational self-efficacy ( $t = 2.02, p > .05$ ). When entered into simple regressions as the sole predictors of pre-test productivity, injury severity accounted for 3% of the variance ( $R\text{-square} = .025$ ),  $F(1, 22) = .572, p > .05$ , and pre-test internal locus of control accounted for 7% of the variance ( $R\text{-square} = .069$ ),  $F(1, 22) = 1.63, p > .05$ . Pre-test vocational self-efficacy accounted for 20% of the variance ( $R\text{-square} = .202$ ) in pre-test productivity, yielding a statistically significant model,  $F(1, 22) = 5.57, p < .05$ .

At follow-up, injury severity, post-test internal locus of control, and post-test vocational self-efficacy accounted for 30% of the variance in post-test productivity scores (R-square= .296), but this model was not found to be statistically significant,  $F(3, 20) = 2.8, p > .05$ . No significant individual relationships were found between post-test productivity and injury severity ( $t = .078, p > .05$ ) or post-test internal locus of control ( $t = -.473, p > .05$ ). However, post-test vocational self-efficacy was found to be a significant predictor of post-test productivity on the CIQ ( $t = 2.84, p < .05$ ). Results of simple regression analyses revealed that injury severity accounted for less than 1% of the variance (R-square= .006) in post-test productivity,  $F(1, 22) = .135, p > .05$ ; post-test internal locus of control accounted for less than 1% of the variance (R-square= .007),  $F(1, 22) = .145, p > .05$ ; and post-test vocational self-efficacy accounted for 28% of the variance (R-square= .288),  $F(1, 22) = 8.87, p < .05$ .

A standard multiple regression analysis revealed that injury severity, change in internal locus of control, and change in vocational self-efficacy (CDESES Vocational Scale difference score) accounted for 40% of the variance (R-square= .404) in change in productivity from pre-test to post-test. The model significantly predicted change in productivity on the CIQ,  $F(3, 20) = 4.52, p < .05$ , and provided partial support for the hypothesis that change in internal locus of control and change in self-efficacy beliefs would be more predictive of change in community integration than injury severity. Injury severity ( $t = -.451, p > .05$ ) and change in internal locus of control ( $t = 1.1, p > .05$ ) were not significant individual predictors of change in productivity on the CIQ. However, change in vocational self-efficacy and change in productivity were significantly correlated ( $r = .58, p < .01$ ), and change in vocational self-efficacy was

found to be a significant predictor of change in productivity ( $t = 2.9, p < .05$ ). Table 7 provides information regarding individual relationships between the independent variables in the model and change in productivity.

**Table 7:**  
**Change in Productivity: Regression Coefficients**

<b>Coefficients(a)</b>						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.130	.376		3.008	.007
	INSEVRTY	-.003	.006	-.086	-.451	.657
	DFFINTER	.061	.055	.215	1.101	.284
	DIFFVOC	.354	.122	.541	2.899	.009

a. Dependent Variable: DIFFPROD

When entered into a simple regression as the only predictor, injury severity failed to significantly predict change in productivity,  $F(1, 22) = .099, p > .05$ , and accounted for 0% of the variance ( $R^2 = .004$ ). In a simple regression, change in internal locus of control accounted for 15% of the variance in change in productivity ( $R^2 = .149$ ), but the model was not found to be statistically significant,  $F(1, 22) = 3.85, p > .05$ . Change in vocational self-efficacy entered into a regression as the only predictor of change in productivity yielded a significant model,  $F(1, 22) = 11.3, p < .05$ , in which change in vocational self-efficacy accounted for 34% of the variance in change in productivity ( $R^2 = .339$ ). Table 8 summarizes the unstandardized regression coefficient, intercept, and standardized regression coefficient for this model.

Table 8:  
Change in Vocational Self-Efficacy as Sole Predictor of Change in Productivity:  
Regression Coefficients

**Coefficients(a)**

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.874	.242		3.620	.002
	DIFFVOC	.381	.113	.583	3.362	.003

a. Dependent Variable: DIFFPROD

## CHAPTER FIVE

### Discussion

The current study evaluated self-efficacy and internal locus of control beliefs as predictors of outcome following TBI independent of injury severity. Although the long-term effects of TBI vary depending on the type and severity of the injury, differences in recovery are seen in persons who appear to have identical injuries (Fuller, 1998). Traditional, medically-based methods of predicting outcome based on measures of injury severity appear to be most useful during the first year post-injury. Thereafter, a combination of environmental, psycho-social, and psychological differences may account for more outcome variability (Brooks, 1990). Therefore, the current study examined cognitive beliefs as predictors of rehabilitation outcomes for a group of individuals with moderate to severe TBI participating in a post-acute, intensive life skills training program.

Consistent with the International Classification of Functioning, Disability, and Health's (ICF) emphasis on the importance of participation despite impairment (WHO, 2001), the construct of community integration served as the primary dependent variable in the study. Community integration is defined as the effectiveness of performing daily activities and engaging in social roles that are valued by the person according to his or her socio-cultural environment and characteristics (Dumont, Gervais, Fougereyrollas, and Bertrand, 2004), and was measured using the Community Integration Questionnaire (CIQ). Self-efficacy in this study was defined as the belief that one can successfully execute the behavior required to produce an outcome (Bandura, 1977), and were measured by the Chronic Disease Self-Efficacy Scales (CDESES) as well as five additional

items written specifically for the study to assess vocational self-efficacy. Internal locus of control was defined as the belief that events are contingent upon one's own behavior (Rotter, 1966), and was measured by the Internal scale of the Multidimensional Health Locus of Control (Form C).

Efforts were made to build upon the identified methodological weaknesses of previous research pertaining to evaluating cognitive beliefs as predictors of outcome following TBI. Specifically, existing studies have exclusively utilized single-measurement designs in order to establish relationships between cognitive variables and outcomes following TBI, limiting the extent to which researchers can determine whether cognitive variables are related over time to the dependent measure of outcome. The current study utilized a pre-test post-test design to examine the impact of internal locus of control and self-efficacy beliefs on community integration following TBI over time. Difference scores were used to evaluate the impact of the independent variables on the dependent variables in an attempt to move a step beyond establishing purely correlational relationships. Given managed healthcare's focus on efficient services, a three-month follow-up interval was used in this study in order to evaluate short-term treatment gains.

It was hypothesized that change in self-efficacy and internal locus of control beliefs would be more predictive of change in community integration from baseline to follow-up than injury severity. In this study, injury severity was not found to be a significant predictor of overall change in community integration, change in home integration, change in social integration, or change in productivity on the CIQ from pre-test to post-test. Change in internal locus of control was found to be a reliable predictor of change in home integration. Change in vocational self-efficacy was found to reliably

predict change in productivity from pre-test to post-test. These results provide partial support for the hypothesis, but also suggest that neurological, psychological, and environmental variables interact to influence post-acute rehabilitation outcomes following TBI.

### *Injury Severity*

Length of time unconscious was used as a measure of injury severity due to the variability of documentation found in participants' medical records. Loss of consciousness is commonly used as a categorization of injury severity along with medical imaging and neuropsychological assessment (Khan, et. al., 2003). During standardization of the Neurobehavioral Functioning Inventory, Kreutzer, Seel, and Marwitz (1999) identified three subgroups of TBI based on the number of days an individual was unconscious and found that three groups differed significantly in the frequency of difficulties reported in the somatic, memory/attention, communication, and motor domains. In this study, injury severity measured by length of time unconscious was used as a continuous variable that ranged from 1 hour to 195 days for study participants. The broad range of loss of consciousness among study participants suggests that there was ample variability in injury severity to allow valid comparison among participants ( $M=56.05$ ,  $SD=48.57$ ).

Traditionally, TBI rehabilitation has ignored the role of psychological variables in the recovery process. However, the narrow focus of medical restoration approaches is being increasingly criticized as a major limitation in TBI rehabilitation (NIH, 1998). The current study hypothesized that change in internal locus of control and self-efficacy beliefs would be more predictive of change in community integration from baseline to



follow-up than injury severity. Consistent with this hypothesis, injury severity was not found to be a significant predictor of change in overall community integration, change in home integration, change in social integration, or change in involvement in productive and meaningful activities from pre-test to post-test. These results suggest that injury severity may not be the best predictor of short-term treatment gains for individuals engaged in post-acute rehabilitation.

In the current study, a significant negative correlation was found between pre-test self-efficacy for completing chores (as measured by the Chores subscale of the CDSSES) and injury severity ( $r = -.470, p < .05$ ). Participants with a greater degree of injury severity tended to report lower level of self-efficacy for completing chores at pre-test. This finding is not surprising as most individuals who sustain a severe TBI are likely to become permanently disabled due to severe cognitive, behavioral, physical, and perceptual deficits (Fuller, 1998). However, a significant positive correlation was also found between injury severity and the Chores scale difference score on the CDSSES ( $r = .511, p < .05$ ), revealing that the greater the participant's injury severity, the greater the amount of change they reported from pre-test to post-test in their self-efficacy for completing chores ( $M = .0296, SD = 2.20$ ). Qualitative analysis of the data revealed that most individuals with more severe injuries reported an increase in their chores self-efficacy from baseline to follow-up. No significant correlations were found between injury severity and locus of control beliefs, social self-efficacy, or vocational self-efficacy. This finding is consistent with Moore and Stambrook's (1992) research indicating that cognitive beliefs associated with the recovery process following TBI may be shaped by factors independent of injury severity.

Although studies vary with respect to which indicators of TBI severity are the best predictors of impairment, there is a general consensus that injury severity is most predictive of outcome during the acute stages of TBI recovery. Brooks (1990) suggested that after the first year post-injury, when recovery slows significantly and appears to plateau, outcomes are determined by variables beyond neurological status including affective, social, and behavioral factors. The current findings support a model that conceptualizes post-acute recovery from TBI as being multi-faceted, rather than predicted by injury severity alone.

### *Locus of Control*

The Multidimensional Health Locus of Control (Form C) (MHLC) was administered as a measure of locus of control beliefs. Form C of the MHLC is an 18-item, general purpose, condition-specific, Likert locus of control scale that can be adapted for use with any medical or health-related condition. Responses are grouped into four subscales: Internality (0-36), Chance (0-36), Doctors (0-18), and Other (powerful) People (0-18) (Wallston, Stein, & Smith, 1994). Participants reported an overall decrease in internal locus of control, chance locus of control, doctors locus of control, and powerful others locus of control from pre-test to post-test. However, only the decrease in the Doctors scale of the MHLC from baseline to follow up ( $M = -2.04$ ,  $SD = 5.28$ ) reached statistical significance ( $t(23) = -2.66$ ,  $p < .05$ ). At pre-test, participants endorsed internal locus of control beliefs most strongly (Internal scale  $M = 30.13$ ,  $SD = 5.42$ ), followed by other locus of control beliefs (Doctors scale  $M = 14.54$ ,  $SD = 3.67$  & Others scale  $M = 12.42$ ,  $SD = 4.8$ ), and chance locus of control beliefs ( $M = 21.42$ ,  $SD = 8.52$ ). Despite the overall decrease in all four scales at post-test, participants still rated their own behavior as

having the most influence over their health status (Internal scale  $M= 28.25$ ,  $SD= 4.55$ ), followed by others' behavior (Doctors scale  $M= 13.46$ ,  $SD= 3.83$  & Others scale  $M= 11.33$ ,  $SD= 3.91$ ), and chance variables as having the least influence (Chance scale  $M= 20.08$ ,  $SD= 7.68$ ). Wallston, Stein, and Smith (1994) have pointed out that, because of the orthogonal nature of the MHLC subscales, it is common to find individuals who simultaneously endorse both internal and external health locus of control beliefs. Therefore, it may be that the overall decrease in all four scales of the MHLC from pre-test to post-test represents a more balanced and accurate appraisal of control of reinforcement beliefs over time.

In the current study, change in internal locus of control from baseline to follow-up was found to reliably predict change in Home Integration on the CIQ when entered into a simple regression as the sole predictor,  $F(1, 22)= 4.95$ ,  $p < .05$ , accounting for 18% of the variance ( $R\text{-square}= .184$ ). Although these results provide partial support for the hypothesis that change in internal locus of control and self-efficacy beliefs would be more predictive of change in community integration from baseline to follow up than injury severity, change in internal locus of control was not predictive of change in home integration in the direction that was anticipated. In other words, a decrease in internal locus of control from pre-test to post-test predicted an increase in home integration from pre-test to post-test. Simple regression analyses in which change in powerful others locus of control, doctors locus of control, and chance locus of control were entered as individual predictors of change in home integration found no significant models, indicating that the negative relationship between change in internal locus of control

beliefs and change in home integration was not accounted for by an associated increase in external locus of control beliefs.

Disturbances in executive functioning are fairly common following TBI due to the high percentage of individuals with frontal lobe damage. Impaired executive functioning is particularly problematic for TBI rehabilitation because the nature of frontal lobe injury is characterized by a lack of awareness related to the accompanying cognitive, emotional, and behavioral symptoms and can impair the individual's ability to recognize the impact of their deficits on ability to function in daily activities and to benefit from rehabilitation (Port, Willmott, & Charlton, 2002). A comparison between pre-test Internal scale scores in the current study ( $M= 30.13$ ) and those of arthritis ( $M= 17.45$ ) and chronic pain patients ( $M=19.20$ ) on which the MHLC Form C was normed (Wallston, Stein, & Smith, 1994), revealed that participants in the current study rated their internal locus of control beliefs significantly higher than did the normative sample. It is possible that impaired executive functioning, and associated low self-awareness of deficits, account for the tendency of study participants to report significantly greater internal locus of control beliefs than the MHLC (Form C) normative group. Therefore, it may be that the negative relationship between change in internal locus of control and change in home integration on the CIQ represents participants' more balanced appraisal of control of reinforcement beliefs over time, particularly since this relationship was characterized by an accompanying decrease in external locus of control beliefs over time.

Although the locus of control construct has been applied to many illness states in the literature, research related to the relationship between locus of control beliefs and rehabilitation outcomes following TBI has been conducted exclusively by Allan Moore,

Michael Stambrook, and their colleagues at the Neuropsychology Research Unit of the Health Sciences Clinical Research Centre in Manitoba, Canada. Several studies conducted by these researchers have found that injury severity is unrelated to locus of control beliefs for TBI survivors (Moore, 1989; Lubusko, et al., 1994; Moore, et al., 1991). Consistent with these findings, the current study found no significant correlations between injury severity and scores on the MHLC at baseline or follow-up, suggesting that cognitive beliefs maybe shaped by factors independent of injury severity, but remain associated with rehabilitation outcomes.

Several studies have demonstrated significant relationships between locus of control beliefs and outcomes following TBI. In a study of 62 males with TBI, Moore (1989) found that individuals who endorsed indiscriminate use of coping strategies, external locus of control beliefs, and negative attributional style for negative events had poorer quality of life status. In a study of 19 individuals with severe TBI, Lubusko, et al. (1994) found that individuals who failed to return to their premorbid level of employment reported significantly lower internal locus of control (as measured by the MHLC) than individuals who were able to return to work. In a study of 53 individuals with moderate to severe TBI Moore, et al. (1991) found that locus of control beliefs accounted for significantly more variance compared to injury severity and education when predicting long-term psychosocial outcome. Although these studies have established strong associations between locus of control beliefs and outcomes following TBI, they utilized single-measurement designs. Moore, et al. (1991) have pointed out the need for studies examining the relationship between locus of control beliefs and outcome variables over time. In the current study, most participants reported greater internal than external locus

of control beliefs at pre-test and post-test, despite the decrease on all scales of the MHLC from baseline to follow-up. Given that change in internal locus of control was predictive of change in home integration on the CIQ from pre-test to post-test, it may be that greater internal than external locus of control beliefs remain associated with positive outcomes following TBI over time, but that balanced and accurate self-appraisal is also predictive of rehabilitation outcomes.

### *Self-Efficacy*

Subscales from the Chronic Disease Self-Efficacy Scales (CDSES) (Do Chores Scale & Social/Recreational Activities Scale) were administered as measures of self-efficacy relevant to home integration and social integration domains assessed by the CIQ. In addition, five items regarding individuals' beliefs in their ability to engage in vocational activities were written specifically for the current study to correspond with the productivity domain assessed by the CIQ. The scales of the CDSES are comprised of Likert scale items ranging from 1 (not at all confident) to 10 (totally confident). The total score for each scale was derived by calculating the mean score for all items constituting the scale. Participants reported marginal increases in overall self-efficacy beliefs (CDSES Total difference score:  $M = .05$ ,  $SD = 1.6$ ), self-efficacy for completing chores (Chores Scale difference score:  $M = .03$ ,  $SD = 2.2$ ), social self-efficacy (Social Scale difference score:  $M = .13$ ,  $SD = 2.2$ ), and vocational self-efficacy (Vocational Scale difference score:  $M = .001$ ,  $SD = 2.18$ ) from pre-test to post-test. However, results of paired samples *t*-tests revealed no statistically significant increases in self-efficacy beliefs from baseline to follow up. It may be that the 3-month follow up interval in the current study was too brief to allow for significant increases in self-efficacy beliefs from pre-test to post-test.

It was hypothesized that change in internal locus of control and self-efficacy beliefs would be more predictive of change in community integration from baseline to follow up than injury severity. Change in overall self-efficacy beliefs was not found to be a significant predictor of change in overall community integration,  $F(1, 22) = .711, p > .05$ , accounting for 3% of the variance ( $R^2 = .031$ ). Change in self-efficacy for completing chores failed to significantly predict change in home integration,  $F(1, 22) = .097, p > .05$ , accounting for 0% of the variance ( $R^2 = .184$ ). Change in social self-efficacy,  $F(1, 22) = 3.56, p > .05$ , was not a significant predictor of change in social integration, accounting for 14% of the variance ( $R^2 = .139$ ). However, change in vocational self-efficacy was a significant predictor of change in productivity on the CIQ,  $F(1, 22) = 11.3, p < .05$ , accounting for 34% of the variance ( $R^2 = .339$ ).

As mentioned previously, disturbances in executive functioning are particularly common following TBI, are associated with poor abstract reasoning, and can impair the individual's ability to recognize the impact of their deficits on ability to function in daily activities and to benefit from rehabilitation (Port, Willmott, & Charlton, 2002). A qualitative analysis of the Home Integration, Social Integration, and Productivity scales of the CIQ revealed that the items on the Home Integration and Social Integration scales require a greater degree of self-awareness than items on the Productivity scale. Whereas items related to home and social integration required participants to identify whether they complete a variety of domestic and social activities independently or with support from someone else, items related to productivity simply required participants to indicate whether or not they were engaged in vocational, educational, or volunteer activities. Results of paired samples  $t$ -tests revealed that the increase in home integration and social

integration from pre-test to post-test did not reach statistical significance, but the increase in productivity from baseline to follow up was statistically significant. It may be that the more concrete nature of questions on the Productivity Scale of the CIQ account for the significant increase in this scale from pre-test to post-test as well as the associated ability of change in self-efficacy beliefs to significantly predict changes in this domain of community integration.

A standard multiple regression revealed that injury severity, change in internal locus of control, and change in vocational self-efficacy accounted for 40% of the variance in change in productivity on the CIQ ( $R\text{-square} = .404$ ), producing a statistically significant model,  $F(3, 20) = 4.52, p < .05$ . In terms of individual relationships between the independent variables and the dependent variable, injury severity ( $t = -.451, p > .05$ ) and change in internal locus of control ( $t = 1.1, p > .05$ ) were not significant individual predictors of change in productivity on the CIQ. However, change in vocational self-efficacy was found to be a significant predictor of change in productivity ( $t = .58, p < .01$ ). When entered into simple regression analyses, injury severity accounted for 0% of the variance in change in productivity on the CIQ ( $R\text{-square} = .004$ ), change in internal locus of control accounted for 15% of the variance ( $R\text{-square} = .149$ ), and change in vocational self-efficacy accounted for 34% of the variance ( $R\text{-square} = .339$ ). Given that the increase in vocational self-efficacy from pre-test to post-test did not approach statistical significance, these results are particularly meaningful and provide partial support for the hypothesis that change in belief systems over time would be more predictive of short-term post-acute rehabilitation outcomes than injury severity.



These findings are consistent with existing research examining the impact of self-efficacy on rehabilitation outcomes for individuals with TBI. In a study of 53 individuals with moderate TBI who were between 1 and 5 years post injury, Dumont, et al. (2004) found that being directed toward goal achievement, having high levels of self-efficacy, and determination accounted for 51% of the variance in social participation. In a study of 45 adults with mild to moderate TBI, Rath, et al. (2003) found that problem solving ability on measures of neuropsychological functioning was not significantly related to community integration, but that participants' problem solving self-appraisal accounted for 21% of the variance in community integration. In a program evaluation study, Cicerone, et al. (2004) found that satisfaction with cognitive functioning was not related to improvements in neuropsychological functioning, but was strongly related to participant's levels of community integration after treatment, and concluded that this relationship reflected participant's perceived self-efficacy regarding their functioning. The current findings provide support for a model that conceptualizes cognitive belief systems as predictors of outcome following TBI over time, independent of injury severity. It may be that belief in one's ability to engage in daily activities and valued social roles increases motivation and approach coping strategies, thereby increasing opportunities for improving community integration.

#### *Clinical Significance of the Study's Findings*

Moore and Stambrook (1995) have proposed a conceptual model of cognitive beliefs and appraisals as predictors of outcome following TBI independent of injury severity. Results of the current study transverse the methodological constraints of existing studies by demonstrating that cognitive beliefs play a role in determining

outcome following TBI over time. Although changes in internal locus of control and vocational self-efficacy did not approach statistical significance over the 3-month follow up interval, change in internal locus of control accounted for 15% of the variance in change in participants' involvement in productive activities and change in vocational self-efficacy accounted for 34% of the variance, whereas injury severity accounted for 0% of the variance. These results provide support for a model that conceptualizes cognitive beliefs as predictors of outcome following TBI independent of injury severity, and suggest that future studies with longer follow up intervals might find more substantial support for self-efficacy and locus of control as predictors of outcome following TBI over time. It may be that self-efficacy and locus of control beliefs are important components of individuals' ability to benefit from TBI rehabilitation efforts, and that rehabilitation models that attempt to limit dysfunctional belief systems are more effective at producing positive outcomes than purely remedial, damage-based models.

Previous studies exploring the relationships between belief systems and outcomes following TBI have pointed to the need for outcome studies investigating interventions based on promoting positive and optimistic appraisal of situations while diminishing denial, resignation, and escape. Dumont, et al. (2004) suggested the need for future research examining outcomes of ecological interventions targeting self-efficacy and will as means of improving social participation. Similarly, Moore and Stambrook (1995) indicated the need for interventions focused on preventing the development of dysfunctional belief systems and promoting increased compliance and benefit from therapies. Participants in the current study were recruited from Radical Rehab Solutions, a holistic rehabilitation program that utilizes a Life Coach Model and principles of social

learning theory in order to increase self-awareness, establish self-efficacy, provide social support, and facilitate context-relevant application of coping skills and compensatory strategies (RRS, 2003). Although results of the current study provide some evidence that involvement in the RRS treatment model was associated with an increase in self-efficacy beliefs and associated increases in community integration, additional research is needed to determine whether these gains were more substantial than those that would be found for individuals involved in traditional rehabilitation efforts or no treatment at all.

In addition to providing support for a model that conceptualizes cognitive beliefs as predictors of outcome following TBI independent of injury severity, results of the current study suggest that accurate self-appraisal may play an important role in TBI rehabilitation. A decrease in internal self-efficacy from pre-test to post-test was found to be a significant predictor of an increase in home integration from pre-test to post test. As this finding was accompanied by an associated decrease in external locus of control beliefs, and the mean internal locus of control scores were significantly higher for participants in the current study than for those on which the MHLC (Form C) was normed, it appears that the negative relationship between change in internal locus of control and change in home integration is accounted for by participants' more balanced and accurate self-appraisal from pre-test to post-test. While positive self-efficacy beliefs appear to be associated with rehabilitation progress following TBI, it seems that individuals' abilities to recognize the impact of their deficits also plays a role in determining benefit from rehabilitation. In a study of 61 individuals with moderate to severe TBI, Ownsworth, et al. (2002) found that impaired executive functioning was the strongest predictor of low self-awareness, but the use of denial as a coping strategy was

associated with lower levels of motivation or readiness to change. Future studies examining the role of locus of control beliefs and rehabilitation outcomes following TBI should include measures of executive functioning and coping style to determine the manner in which neuropsychological and psychological processes are interactive factors underlying control of reinforcement beliefs.

### *Limitations of the Study*

Participants in the current study were all Caucasian, English-speaking individuals residing in southern West Virginia and eastern Kentucky. As the study's sample was not representative of the general population in terms of ethnicity or geographic region, the results may not be generalizable to individuals from different cultural backgrounds, particularly since cultural is largely influential in the development of belief systems.

Nineteen males and five females participated in the study. Although this is consistent with the incidence of TBI in the general population, as males are more than twice as likely as females to sustain TBI (NIH, 1998), a balanced ratio of male to female participants would have allowed for investigation of the manner in which gender impacts beliefs related to TBI recovery. In the current study, females reported a significantly greater decrease in internal locus of control beliefs than males from baseline to follow-up. In addition, females reported significantly greater self-efficacy for completing chores at pre-test than males. These results suggest that differences in self-efficacy and locus of control beliefs exist between males and females and warrant further exploration.

The final study sample of 24 participants was consistent with existing standards for research with TBI populations, which recommend a sample size of at least 20 (Goranson, et al., 2003). However, George and Mallery (2006) point out that, while there

are no strict rules concerning acceptable sample size in studies utilizing multiple regression analyses, as the sample size drops below 50, the validity of the results become increasingly questionable. While the number of participants in the study was generally consistent with other studies utilizing similar methodology, a larger sample size would have enhanced the confidence and generalizability of the results.

Given managed healthcare's focus on efficient services, a three-month follow-up interval was used in order to evaluate change in community integration, self-efficacy beliefs, and locus of control beliefs over time. Although significant increases were found on the CIQ Total Score and Productivity Scale from pre-test to post-test, increases on the Home Integration and Social Integration scales from baseline to follow-up did not reach statistical significance. As recovery after TBI tends to slow and appears to plateau following the first year post-injury (RRS, 2003), it may be that a longer follow-up interval was needed to allow for more significant gains in community integration. In terms of changes in belief systems over the follow-up interval, only the Doctors scale of the MHLC (Form C) revealed a significant change from pre-test to post-test. Increases in self-efficacy beliefs on the CDESES did not approach statistical significance. Since long-term functional gains are the objective of TBI rehabilitation, a longer follow-up interval may have added greater clarity to the results of the current study and provided more confidence in the relationship between cognitive beliefs and outcome following TBI over time.

Finally, although efforts were made to select an outcome instrument that measures direct outcomes of TBI rehabilitation and is consistent with existing standards in TBI research, examination of participant responses on the CIQ revealed the limitations of the

instrument. Items on the Home Integration and Social Integration scales of the CIQ require that participants rate whether they complete a variety of domestic and vocational activities independently or with the support of someone else. The lack of specificity of these items suggests that the instrument may not have captured some of the gains made by participants. Conversely, the lack of specificity of these items could also have made it difficult for participants with impaired executive functioning to accurately appraise their own functioning in these domains. Although the Productivity Scale of the CIQ asks that participants indicate the degree to which they are involved in vocational, academic, and volunteer activities (full-time, part-time, etc.), it does not distinguish between sheltered and regular work environments. It may be that the results of the current study may have been more accurate with the use of a more detailed instrument assessing community integration.

#### *Recommendations for Future Studies*

The findings from the current study warrant further investigation pertaining to the relationship between self-efficacy, locus of control beliefs, and community integration over time. Although partial support was found for the hypothesis that change in self-efficacy and locus of control beliefs would be more predictive of change in community integration from pre-test to post-test than injury severity, a longer follow-up interval would likely produce more significant changes in self-efficacy, locus of control beliefs, and community integration and add greater clarity to the results. The current study provides support for a model in which cognitive beliefs are predictors of outcome following TBI independent of injury severity, and suggests the need for interventions that limit dysfunctional belief systems. Employing multiple periods of follow-up is needed to

determine both the short-term and long-term effects of change in belief systems on change in community integration in order to develop appropriate interventions based on the findings. Participants in the current study were recruited from a small geographic area and were homogeneous in terms of ethnic diversity. Future studies with larger samples sizes including a more culturally diverse sample would greatly enhance the confidence and generalizability of the findings.

The negative relationship found between change in internal locus of control beliefs and home integration in the current study warrants further exploration. Although this relationship was accompanied by an associated decrease in external locus of control beliefs, suggesting that the findings indicate more balanced appraisal of control of reinforcement beliefs over time, this hypothesis requires further analysis. Future studies examining the relationship between change in locus of control beliefs and change in community integration over time would benefit from including measures of executive functioning as well as coping style to assess the neuropsychological and psychological factors underlying control of reinforcement appraisals for individuals following TBI.

Although results of the current study provide some evidence that involvement in the RRS treatment model was associated with an increase in self-efficacy beliefs and associated increases in community integration, additional research is needed to determine whether these gains were more substantial than those that would be found for individuals involved in traditional rehabilitation efforts or no treatment at all. Outcome studies in which RRS program participants are paired with matched controls are needed to determine whether participation in a holistic rehabilitation program targeting self-efficacy beliefs results in significantly greater increases in positive belief systems and associated

treatment outcomes. Given the CIQ's lack of sensitivity to some aspects of community integration, a more extensive measure of community integration would be appropriate to evaluate treatment gains.



## References

- Allegrante, J.P., Kovar, P.A., Mackenzie, C.R., Peterson, M., & Gutin, B. (1993).  
A walking programme for patients with osteoarthritis of the knee: Theory and  
intervention strategies. *Health Education Quarterly*, 20, 63-81.
- Asikainen, I., Kaste, M., & Sarna, S. (1998). Predicting late outcome for patients with  
traumatic brain injury referred to a rehabilitation programme: a study of 508  
Finnish patients 5 years or more after injury. *Brain Injury*, 12, 95-107.
- Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change.  
*Psychological Review*, 84, 191-215.
- Bond, M. (1990). Standardized methods of assessing and predicting outcome. In  
M. Rosenthal, E. Griffith, J. Kreutzer, & B. Pentland (Eds.) *Rehabilitation of the  
adult and child with traumatic brain injury* (pp. 59-76). Philadelphia, PA: FA  
Davis.
- Brooks, D.N. (1990). Cognitive deficits. In M. Rosenthal, E. Griffith, J. Kreutzer, & B.  
Pentland (Eds.) *Rehabilitation of the adult and child with traumatic brain  
injury* (pp. 163-178). Philadelphia, PA: FA Davis.
- Brown, M., Gordon, W.A., & Haddad, L. (2000). Models for predicting subjective  
quality of life in individuals with traumatic brain injury. *Brain Injury*, 14,  
5-19.
- Buescher, K.L., Johnston, J.A., Parker, J.C., Smarr, K.L., Buckelew, S.P., Anderson, S.  
K., & Walker, S.E. (1991). Relationship of self-efficacy to pain behavior.  
*Journal of Rheumatology*, 18, 968-972.

- Carney, N., Chesnut, R.M., & Maynard, H. (1999). Effect of cognitive rehabilitation on outcomes for persons with traumatic brain injury: a systematic review. *Journal of Head Trauma Rehabilitation*, 14, 176-188.
- Centers for Disease Control [CDC] (2003). *Traumatic brain injury in the United States: A report to Congress*. <http://www.cdc.gov/ncipc/pub-res/tbicongress.htm>.
- Cicerone, K.D. (2004). Participation as an outcome of traumatic brain injury rehabilitation. *Journal of Head Trauma Rehabilitation*, 19, 494-501.
- Cicerone, K.D., Mott, T., Azulay, J., & Friel, J.C. (2004). Community integration and satisfaction with functioning after intensive cognitive rehabilitation for traumatic brain injury. *Archives of Physical and Medical Rehabilitation*, 85, 943-950.
- Curran, C., Ponsford, J., & Crowe, S. (2000). Coping strategies and emotional outcome following traumatic brain injury: A comparison with orthopedic patients. *Journal of Head Trauma Rehabilitation*, 15, 1256-1274.
- Cvengros, J.A., Christensen, A.J., & Lawton, W.J. (2005). Health locus of control and depression in chronic kidney disease: A dynamic perspective. *Journal of Health Psychology*, 10, 677-686.
- Dumont, C., Gervais, M., Fougereyrollas, P., & Bertrand, R. (2004). Toward an explanatory model of social participation for adults with traumatic brain injury. *Journal of Head Trauma Rehabilitation*, 19, 431-444.
- Endler, N.S., Kocovski, N.L., & Macrodimitris, S.D. (2001). Coping, efficacy, and perceived control in acute vs. chronic illness. *Personality and Individual Differences*, 30, 617-625.

- Folkman, S. (1984). Personal control and coping processes: A theoretical analysis. *Journal of Personality and Social Psychology*, 46, 839-852.
- Fuller, K. (1998). Traumatic brain injury. In C. Goodman & W. Boissonnault (Eds.), *Pathology: Implications for the physical therapist* (pp. 763-774). Philadelphia, PA: WB Saunders Company.
- George, D. & Mallery, P. (2006). *SPSS for windows step by step: A simple guide and reference*. Boston: Pearson Education, Inc.
- Goranson, T.E., Graves, R.E., Allison, D., & La Freniere, R. (2003). Community integration following multidisciplinary rehabilitation for traumatic brain injury. *Brain Injury*, 17, 759-774.
- Hart, T., Bogner, J., & Whyte, J. (2003). Attribution of blame in accidental and violence-related traumatic brain injury. *Rehabilitation Psychology*, 48, 86-92.
- Hellstrom, K., Lindmark, B., Wahlberg, B., & Fugl-Meyer, A.R. (2003). Self-efficacy in relation to impairments and activities of daily living disability in elderly patients with stroke: A prospective investigation. *Journal of Rehabilitation Medicine*, 35, 202-207.
- Hoofien, D., Gilboa, A., Vakil, E., & Donovanick, P. (2001). Traumatic brain injury (TBI) 10-20 years later: A comprehensive outcome study of psychiatric symptomatology, cognitive abilities, and psychosocial functioning. *Brain Injury*, 15, 189-209.
- Jennett, B., & Teasdale, G. (1981). *Management of head injuries*. Philadelphia, PA: FA Davis.

- Johnston, M., Morrison, V., Macwalter, R., & Partridge, C. (1999). Perceived control, coping, and recovery from disability following stroke. *Psychology & Health, 14*, 181-193.
- Johnstone, B., Price, T., Bounds, T., Schopp, L., Schootman, M., & Schumate, D. (2003). Rural/urban differences in vocational outcomes for state vocational rehabilitation clients with TBI. *NeuroRehabilitation, 18*, 197-203.
- Jones, M.L., Patrick, P.D., Evans, R.W., & Wulff, J.J. (1991). The life coach model of community re-entry. In B.T. McMahon & L.R. Shaw (Eds.), *Work worth doing: advances in brain injury rehabilitation*, (pp. 279-302). Orlando, FL: Paul M. Deutsch Press, Inc.
- Karlovits, T. & McColl, M. (1999). Coping with community reintegration after severe brain injury: A description of stresses and coping strategies. *Brain Injury, 13*, 845-861.
- Kersel, D., Marsh, N., Havill, J. & Sleigh, J. (2001). Neuropsychological functioning during the year following severe traumatic brain injury. *Brain Injury, 15*, 283-296.
- Khan, F., Baguley, J. & Cameron, I. (2003). Rehabilitation after traumatic brain injury. *Medical Journal Archives, 178*, 290-295.
- Kohler, C.L., Fish, L., & Greene, P.G. (2002). The relationship of perceived self-efficacy to quality of life in chronic obstructive pulmonary disease. *Health Psychology, 21*, 610-614.

- Kraus, J. & McArthur, D. (1999). Incidence and prevalence of, and cost associated with, traumatic brain injury. In M. Rosenthal, E. Griffith, J. Kreutzer, & B. Pentland (Eds.) *Rehabilitation of the adult and child with traumatic brain injury* (pp. 74-86). Philadelphia, PA: FA Davis.
- Kraus, M.F. (2002). *Traumatic brain injury: A brief overview of traumatic injuries and the neurobehavioral deficits that can occur*. <http://ccm.psych.uic.edu/Research/TBIinfo.htm>.
- Kreutzer, J., Seel, R., & Marwitz, J. (1999). *Neurobehavioral Functioning Inventory*. San Antonio: The Psychological Corporation.
- Kreutzer, J., Zasler, N., Camplair, P. & Leininger, B. (1990). A practical guide to family intervention following adult traumatic brain injury. In J. Kreutzer & P. Wehman (Eds.), *Community integration following traumatic brain injury* (pp. 249-273). Baltimore, MD: Paul H. Brookes Publishers.
- Lazarus, R.S., & Folkman, S. (1984). *Stress, appraisal, and coping*. New York: Springer.
- Lannoo, E., Colarydn, F., Jannes, C., & De Soete, G. (2001). Course of neuropsychological recovery from moderate-to-severe head injury: a 2-year follow-up. *Brain Injury*, 15, 1-13.
- Lorig, K., Stewart, A., Ritter, P., Gonzalez, V., Laurent, D., & Lynch, J. (1996). *Outcome measures for health education and other health care interventions*. Thousand Oaks CA: Sage Publications.

- Lubusko, A.A., Moore, A.D., Stambrook, M. & Gill, D. (1994). Cognitive beliefs following severe traumatic brain injury: association with post-injury employment status. *Brain Injury*, 8, 65-70.
- Mandleger, I.A., & Brooks, D.N. (1975). Cognitive recovery after severe head injury: serial testing on the Wechsler Adult Intelligence Scale. *Journal of Neurology, Neurosurgery, and Psychiatry*, 38, 1121-1130.
- Marks, R. (2001). Efficacy theory and its utility in arthritis rehabilitation: Review and recommendations. *Disability and Rehabilitation*, 23, 271-280.
- McColl, M.A., Carlson, P., Johnston, J., Minnes, P., Shues, K., Davies, D., & Karlovits, T. (1998). The definition of community integration: Perspective of people with brain injuries. *Brain Injury*, 12, 15-30.
- Minnes, P., Carlson, P., McColl, M.A., Nolte, M.L., Johnston, J., & Buell, K. (2003). Community integration: a useful construct, but what does it really mean? *Brain Injury*, 17, 149-159.
- Moore, A.D. (1989). Belief structure and coping style following closed head injury: relationship of injury severity and psychosocial outcome. Unpublished masters thesis, University of Manitoba, Winnipeg, Manitoba, Canada.
- Moore, A.D., & Stambrook, M. (1995). Cognitive moderators of outcome following Traumatic brain injury: A conceptual model and implications for rehabilitation. *Brain Injury*, 9, 109-130.
- Moore, A.D. , & Stambrook, M. (1994). Coping following traumatic brain injury (TBI): Derivation and validation of TBI sample ways of coping-revised subscales. *Canadian Journal of Rehabilitation*, 7, 193-200.

- Moore, A.D., & Stambrook, M. (1992). Coping strategies and locus of control following traumatic brain injury: relationship to long-term outcome. *Brain Injury*, 6, 89-94.
- Moore, A.D., Stambrook, M., & Peters, L. (1989). Coping strategies and adjustment after closed-head injury: a cluster analytical approach. *Brain Injury*, 3, 171-175.
- Moore, A.D., Stambrook, M., & Wilson, K.G. (1991). Cognitive moderators in adjustment to chronic illness: Locus of control beliefs following traumatic brain injury. *Neuropsychological Rehabilitation*, 1, 185-198.
- Nagy, V.T. & Wolfe, G.R. (1983). Chronic illness and health locus of control beliefs. *Journal of Social and Clinical Psychology*, 1, 58-65.
- National Institutes of Health [NIH], (1998). Rehabilitation of persons with traumatic brain injury. *NIH Consensus Statement*, 16, 1-41.
- Norman, J. & Norman, V.L. (1991). Relationship of patients' health locus of control beliefs to progress in rehabilitation. *Journal of Rehabilitation*, 27-29.
- Owensworth, T., McFarland, K., & Young, R. (2002). The investigation of factors underlying deficits in self-awareness and self-regulation. *Brain Injury*, 16, 291-309.
- Peek-Asa, C., Zwerling, C. & Stallones, L. (2004). Acute traumatic injuries in rural populations. *American Journal of Public Health*, 94, 1689-1693.
- Port, A., Willmott, C. & Charlton, J. (2002). Self-awareness following traumatic brain injury and implications for rehabilitation. *Brain Injury*, 16, 277-289.
- Radical Rehab Solutions, LLC. (2003). *Transitional living program overview*.  
Huntington, WV: James P. Phifer.

- Rath, J.F., Hennessy, J.J., & Diller, L. (2003). Social problem solving and community integration in postacute rehabilitation outpatients with traumatic brain injury. *Rehabilitation Psychology*, 48, 137-144.
- Rosenthal, M., & Bond, M. (1990). Behavioral and psychiatric sequelae. .  
In M. Rosenthal, E. Griffith, J. Kreutzer, & B. Pentland (Eds.) *Rehabilitation of the adult and child with traumatic brain injury* (pp. 179-192). Philadelphia, PA: FA Davis.
- Rotter, J.B. (1966). Generalized expectancies for internal versus external control of reinforcement. *Psychological Monographs: General and Applied*, 80 (1, Whole No. 609).
- Rotter, J.B., Chance, J.E., & Phares, E.J. (1972). *Applications of a social learning theory of personality*. New York: Holt, Rinehart, and Winston, Inc.
- Ruff, R.M. & Jurica, P. (1999). In search of a unified definition for mild traumatic brain injury. *Brain Injury*, 13, 943-952.
- Sander, A., Fuchs, K., High Jr., Hall, Kreutzer, & Rosenthal. (1999). The Community Integration Questionnaire revisited: An assessment of structural validity. *Archives of Physical Medicine and Rehabilitation*, 80, 1303-1309.
- Sander A., Seel R., Kreutzer J., Hall K., High W., & Rosenthal M. (1997). Agreement between persons with traumatic brain injury and their relatives regarding psychosocial outcome using the Community Integration Questionnaire. *Archives of Physical Medicine and Rehabilitation*, 78, 353-357.



- Schiaffino, K.M., & Revenson, T.A. (1992). The role of perceived self-efficacy, perceived control, and causal attributions in adaptation to rheumatoid arthritis: Distinguishing mediator from moderator effects. *Personality and Social Psychology Bulletin*, 18, 709-718.
- Schootman, M., & Fuortes, L. (1999). Functional status following traumatic brain injuries: population-based rural-urban differences. *Brain Injury*, 13, 995-1004.
- Shelley, M., & Pakenham, K. (2004). External locus of control and general self-efficacy: Moderators of emotional distress among university students. *Australian Journal of Psychology*, 56, 191-199.
- Wallace, C., & Bogner, J. (2000). Awareness of deficits: emotional implications for persons with brain injury and their significant others. *Brain Injury*, 14, 549-562.
- Wallston, K.A. (1998). *Multidimensional Health Locus of Control (MHLC) Scale*. Retrieved on September 27, 2005, from <http://www.vanderbilt.edu/nursing/kwallston/scoringmhlc.htm>.
- Wallston, K.A., Stein, M.J., & Smith, C.A. (1994). Form C of the MHLC Scales: A condition-specific measure of locus of control. *Journal of Personality Assessment*, 63, 534-553.
- West Virginia Department of Health and Human Services. (2005). Chapter 15: Injury and violence prevention. In *West Virginia Health People 2010*. <http://www.wvdhhr.org/bph/hp2010/objective/15/htm>.

- Willer, B., Ottenbacher, K., & Coad, M. (1994). The Community Integration Questionnaire: A comprehensive examination. *The American Journal of Physical Medicine and Rehabilitation*, 73, 103-111.
- Willer, B., Linn, R., & Allen, K. (1993). Community integration and barriers to Integration for individuals with traumatic brain injury. In M. Finlayson & S. Garner (Eds.), *Brain injury Rehabilitation: Clinical considerations* (pp. 355-375). Baltimore, MD: Williams & Wilkins.
- Winkler, P. (2001). Traumatic brain injury. In D. Umphred (Ed.), *Neurological rehabilitation* (pp. 416-447). St. Louis, MI: Mosby.
- World Health Organization. (2001). *International classification of functioning, disability, and health*. Geneva, Switzerland: WHO.
- Wu, A.M.S., Tang, C.S.K., & Kwok, T.C.Y. (2004). Self-efficacy, health locus of control, and psychological distress in elderly Chinese women with chronic illness. *Aging & Mental Health*, 8, 21-28.
- Ylvisaker, M., Hanks, R., & Johnson-Greene, D. (2002). Perspectives on rehabilitation of individuals with cognitive impairment after brain injury: Rationale for reconsideration of theoretical paradigms. *Journal of Head Trauma Rehabilitation*, 17, 191-209.

## Appendix A

**Multidimensional Health Locus of Control (Form C)**

Instructions: Each item below is a belief statement about your medical condition with which you may agree or disagree. Beside each statement is a scale which ranges from strongly disagree (1) to strongly agree (6). For each item we would like you to circle the number that represents the extent to which you agree or disagree with that statement. The more you agree with a statement, the higher will be the number you circle. The more you disagree with a statement, the lower will be the number you circle. Please make sure that you answer **EVERY ITEM** and that you circle **ONLY ONE** number per item. This is a measure of your personal beliefs; obviously, there are no right or wrong answers.

1=STRONGLY DISAGREE ( <b>SD</b> )	4=SLIGHTLY AGREE ( <b>A</b> )
2=MODERATELY DISAGREE ( <b>MD</b> )	5=MODERATELY AGREE ( <b>MA</b> )
3=SLIGHTLY DISAGREE ( <b>D</b> )	6=STRONGLY AGREE ( <b>SA</b> )

		<b>SD</b>	<b>MD</b>	<b>D</b>	<b>A</b>	<b>MA</b>	<b>SA</b>
1	If my condition worsens, it is my own behavior which determines how soon I will feel better again.	1	2	3	4	5	6
2	As to my condition, what will be will be.	1	2	3	4	5	6
3	If I see my doctor regularly, I am less likely to have problems with my condition.	1	2	3	4	5	6
4	Most things that affect my condition happen to me by chance.	1	2	3	4	5	6
5	Whenever my condition worsens, I should consult a medically trained professional.	1	2	3	4	5	6
6	I am directly responsible for my condition getting better or worse.	1	2	3	4	5	6
7	Other people play a big role in whether my condition improves, stays the same, or gets worse.	1	2	3	4	5	6
8	Whatever goes wrong with my condition is my own fault.	1	2	3	4	5	6
9	Luck plays a big part in determining how my condition improves.	1	2	3	4	5	6
10	In order for my condition to improve, it is up to other people to see that the right things happen.	1	2	3	4	5	6
11	Whatever improvement occurs with my condition is largely a matter of good fortune.	1	2	3	4	5	6
12	The main thing which affects my condition is what I myself do.	1	2	3	4	5	6

13	I deserve the credit when my condition improves and the blame when it gets worse.	1	2	3	4	5	6
14	Following doctor's orders to the letter is the best way to keep my condition from getting worse.	1	2	3	4	5	6
15	If my condition worsens, it's a matter of fate.	1	2	3	4	5	6
16	If I am lucky, my condition will get better.	1	2	3	4	5	6
17	If my condition takes a turn for the worse, it is because I have not been taking proper care of myself.	1	2	3	4	5	6
18	The type of help I receive from other people determines how soon my condition improves.	1	2	3	4	5	6

## Appendix B

## Chronic Disease Self-Efficacy Scales

**Instructions:** We would like to know how confident you are in doing certain activities. For each of the following questions, please circle the number that corresponds to your confidence that you can do the tasks regularly at the present time.

**Obtain Help from Community, Family, Friends Scale**

Not at all confident   1   2   3   4   5   6   7   8   9   10   Totally confident

1. How confident are you that you can get family and friends to help you with the things you need (such as household chores like shopping, cooking, or transport)?

Not at all confident   1   2   3   4   5   6   7   8   9   10   Totally confident

2. How confident are you that you can get emotional support from friends and family (such as listening or talking over your problems)?

Not at all confident   1   2   3   4   5   6   7   8   9   10   Totally confident

3. How confident are you that you can get emotional support from resources other than friends or family, if needed?

Not at all confident   1   2   3   4   5   6   7   8   9   10   Totally confident

4. How confident are you that you can get help with your daily tasks (such as housecleaning, yard work, meals, or personal hygiene) from resources other than friends or family, if needed?)

**Do Chores Scale**

Not at all confident   1   2   3   4   5   6   7   8   9   10   Totally confident

1. How confident are you that you can complete your household chores, such as vacuuming and yard work, despite your health problems?

Not at all confident   1   2   3   4   5   6   7   8   9   10   Totally confident

2. How confident are you that you can get your errands done despite your health problems?

Not at all confident 1 2 3 4 5 6 7 8 9 10 Totally confident

3. How confident are you that you can get your shopping done despite your health problems?

### **Social/Recreational Activities Scale**

Not at all confident 1 2 3 4 5 6 7 8 9 10 Totally confident

1. How confident are you that you can continue to do your hobbies and recreation?

Not at all confident 1 2 3 4 5 6 7 8 9 10 Totally confident

2. How confident are you that you can continue to do the things you like to do with friends and family (such as social visits and recreation)?

### **Vocational Self-Efficacy Scale** (constructed specifically for study to correspond with productivity subscale of the CIQ)

Not at all confident 1 2 3 4 5 6 7 8 9 10 Totally confident

1. How confident are you in your ability to look for a job or seek employment opportunities?

Not at all confident 1 2 3 4 5 6 7 8 9 10 Totally confident

2. How confident are you in your ability to engage in work/employment (on a part-time or full time basis)?

Not at all confident 1 2 3 4 5 6 7 8 9 10 Totally confident

3. How confident are you in your ability to attend school or special training programs?

Not at all confident 1 2 3 4 5 6 7 8 9 10 Totally confident

4. How confident are you in your ability to participate in volunteer activities?

## Appendix C

**Community Integration Questionnaire**

1. Who usually does the shopping for groceries or other necessities in your household?	<input type="radio"/> Yourself alone <input type="radio"/> Yourself and someone else <input type="radio"/> Someone else
2. Who usually prepares the meals in your household?	<input type="radio"/> Yourself alone <input type="radio"/> Yourself and someone else <input type="radio"/> Someone else
3. In your home who usually does the everyday housework?	<input type="radio"/> Yourself alone <input type="radio"/> Yourself and someone else <input type="radio"/> Someone else
4. Who usually cares for the children in your home?	<input type="radio"/> Yourself alone <input type="radio"/> Yourself and someone else <input type="radio"/> Someone else <input type="radio"/> Not applicable, no children under 17 in the home
5. Who usually plans social arrangements such as get-togethers with family and friends?	<input type="radio"/> Yourself alone <input type="radio"/> Yourself and someone else <input type="radio"/> Someone else
6. Who usually looks after your personal finances, such as banking or paying bills?	<input type="radio"/> Yourself alone <input type="radio"/> Yourself and someone else <input type="radio"/> Someone else
7. Approximately how many times a month do you usually participate in shopping outside your home?	<input type="radio"/> Never <input type="radio"/> 1-4 times <input type="radio"/> 5 or more
8. Approximately how many times a month do you usually participate in leisure activities such as movies, sports, restaurants, etc.	<input type="radio"/> Never <input type="radio"/> 1-4 times <input type="radio"/> 5 or more
9. Approximately how many times a month do you usually visit your friends or relatives?	<input type="radio"/> Never <input type="radio"/> 1-4 times <input type="radio"/> 5 or more
10. When you participate in leisure activities do you usually do this alone or with others?	<input type="radio"/> Mostly alone <input type="radio"/> Mostly with friends who have head injuries <input type="radio"/> Mostly with family Members <input type="radio"/> Mostly with friends who do not have head injuries <input type="radio"/> With a combination of family and friends
11. Do you have a best friend with whom you confide?	<input type="radio"/> Yes <input type="radio"/> No

12. How often do you travel outside the home?	<input type="radio"/> Almost every day <input type="radio"/> Almost every week <input type="radio"/> Seldom/never (less than once per week)
13. Please choose the answer that best corresponds to your current (during the past month) work situation:	<input type="radio"/> Full-time (more than 20 hours/week) <input type="radio"/> Part time (less than or equal to 20 hours/week) <input type="radio"/> Not working, but actively looking for work <input type="radio"/> Not working, not looking for work <input type="radio"/> Not applicable, retired due to age
14. Please choose the answer that best corresponds to your current (during the past month) school or training program situation:	<input type="radio"/> Full-time <input type="radio"/> Part-time <input type="radio"/> Not attending school or training program <input type="radio"/> Not applicable, retired due to age
15. In the past month, how often did you engage in volunteer activities?	<input type="radio"/> Never <input type="radio"/> 1-4 times <input type="radio"/> 5 or more
<b>Comments:</b>	



Appendix D

## **Informed Consent to Participate in a Research Study**

### **Self-Efficacy and Locus of Control: Predictors of Community Integration Following Moderate to Severe Traumatic Brain Injury**

Thomas E. Ellis, Psy.D., Principal Investigator  
Agnieszka Hornich, M.A., Co-Investigator

#### **Introduction**

You are invited to be in a research study. Research studies are designed to gain scientific knowledge that may help other people in the future. You may or may not receive any benefit from being part of the study. There may also be risks associated with being part of research studies. Your participation is voluntary. Please take your time to make your decision, and ask your research investigator or research staff to explain any words or information that you do not understand.

#### **Why Is This Study Being Done?**

The purpose of this study is to explore whether people's beliefs influence how they recover from brain injury. In particular, we are looking at how various beliefs about control might relate to recovery following brain injury. We will also look at the effects of severity of the injury.

#### **How Many People Will Take Part In The Study?**

About 40 people will take part in this study. A total of 60 people are the most that would be able to enter the study.

#### **What Is Involved In This Research Study?**

In this study, persons with moderate to severe brain injuries will be asked to complete three short questionnaires about their control beliefs and current level of community functioning. Participants' responses on the questionnaires will be compared with their injury severity to determine which is more closely related to their responses on the community functioning questionnaire.

### *How Long Will I Be In The Study?*

You will be asked to complete questionnaires on two occasions- once at the beginning of your participation in the study and again 90 days later. Each time, the study will require about 30 minutes of your time.

You can decide to stop participating at any time without any penalty whatsoever. If you decide to stop participating in the study we encourage you to talk to the study investigator or study staff as soon as possible.

### *What Procedures Will Be Performed In The Study?*

If you decide to be in this research study, you will be asked to sign this consent form after you have had all of your questions answered. If you wish to be in this study and you have a legal guardian, we are required to get your guardian's written permission also.

When you are first visited by one of the research staff you will be asked to complete an information form that contains basic questions about you and your injury. You will then be asked to complete three questionnaires. The Multidimensional Health Locus of Control questionnaire contains 18 statements that you will be asked to rate. The Chronic Disease Self-Efficacy Scales contains 14 statements that you will be asked to rate. The Community Integration Questionnaire contains 15 questions that you and your spouse/caregiver will be asked by one of the researchers. The evaluation process should not take longer than 30 minutes. 90 days later we will come back for visit 2. You will be asked by the research staff to complete the same three questionnaires, just like you did the first time. We would keep your name on a list so that we can contact you at the 90-day follow-up. This list will be destroyed after we have gathered information from everyone in the study, and reviewed it to be sure it is accurate.

### *What Are The Risks Of The Study?*

There are no known risks or discomforts to those who take part in this study beyond the time and inconvenience associated with completing the three questionnaires with a study researcher on two separate occasions. Participants generally consider these questionnaires to be easy to complete and nonpersonal in nature. However, you should tell the researcher if you experience any discomfort related to your participation in the study.

### *Are There Benefits To Taking Part In The Study?*

There are no direct benefits to participating in the study. The study is intended to assist in developing a better understanding of recovery following traumatic brain injury in terms of the relationship between self-efficacy and locus of control beliefs and their effect on community integration. We hope that the information obtained from this study

may improve the quality of rehabilitation for traumatic brain injury survivors in the future.

### *What About Confidentiality?*

We will do our best to make sure that your personal information is kept confidential. However, we cannot guarantee absolute confidentiality. Federal law says we must keep your study records private. Nevertheless, under unforeseen and rare circumstances, we may be required by law to allow certain agencies to view your records. Those agencies would include the Marshall University IRB, Office of Research Integrity (ORI) and the federal Office of Human Research Protection (OHRP). This is to make sure that we are protecting your rights and your safety. If we publish the information we learn from this study, you will not be identified by name or in any other way.

### *What Are The Costs Of Taking Part In This Study?*

There are no costs to you for taking part in this study. All the study costs, including any study tests, supplies and procedures related directly to the study, will be paid for by the study.

### *Will I Be Paid For Participating?*

You will receive no payment or other compensation for taking part in this study.

### *What Are My Rights As A Research Study Participant?*

Taking part in this study is voluntary. You may choose not to take part or you may leave the study at any time. Refusing to participate or leaving the study will not result in any penalty or loss of benefits to which you are entitled. If you decide to stop participating in the study we encourage you to talk to the investigators or study staff first.

*Whom Do I Call If I Have Questions Or Problems?*

In the future, you may have questions or concerns about your study participation. If you have any questions, please contact:

Agnieszka Hornich, M.A.  
Co-Investigator, Psy.D. Student Researcher  
(304) 208-3425

or

Dr. Thomas E. Ellis  
Principal Investigator, Dissertation Chair  
Marshall University  
Department of Psychology  
Harris Hall 326  
Huntington, WV 25755  
(304) 696-2776

For questions about your rights as a research participant, contact the Marshall University IRB#2 Chairman Dr. Stephen Cooper or ORI at (304) 696-7320. You may also call this number if:

- You have concerns or complaints about the research.
- The research staff cannot be reached.
- You want to talk to someone other than the research staff.

You will be given a signed and dated copy of this consent form.

***SIGNATURES***

I agree to take part in this study and I confirm that I am 18 years of age or older. I have had a chance to ask questions about being in this study and have those questions answered. By signing this consent form I have not given up any legal rights to which I am entitled.

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Subject Name (Printed)

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Subject Signature

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Date

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Person Obtaining Consent (Printed)

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Person Obtaining Consent Signature

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Date

---

Witness

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Date

---

Legally Authorized Representative Signature

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Date

